PHYTOBIAL REMEDIATION OF ARSENIC-CONTAMINATED SOIL USING *Melastoma malabathricum* L. AND *Microbacterium foliorum* STRAIN SZ1

SADIYA ALKA

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy

Faculty of Science
Universiti Teknologi Malaysia

MAY 2022

DEDICATION

To Allah, The One and Only

ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious and the Most Merciful.

All praise be to Allah, and His blessing upon the completion of this research. I thank God for all the opportunities, trials, and strength that I have been given to finish writing this thesis. I have had so much experience in this process, not only from the academic point of view, but also from the point of view of personality.

First and foremost, I would like to express my special gratitude to my main supervisor, Dr. Fazilah Binti Abd Manan, and to my co-supervisors, Dr. Shafinaz Binti Shahir, and Dr. Norahim Ibrahim, who have given me the golden opportunity to do this wonderful thesis, which has also helped me to do a lot of research, and I have come to know so many new things that I thank them for. I am also grateful for their guidance, understanding, patience and, most importantly, to complete this thesis, they have provided positive encouragement and a warm spirit. It was a great pleasure and honour to have them as my supervisors.

Secondly, I would also like to thank Dr. Umar Alka and Hajiya Samina Alka, my parents, for their financial and moral support, love, and enthusiastic encouragement, without whom I would never have had so many opportunities. May Allah reward you with the highest rank in Jannatul Firdaus Amin. Special thanks go out to Dr. Umar Bala, my steadfast husband, for being a wonderful mentor to me, and thank you for supporting me. I also thank you for your perseverance and diligence in guiding me through my studies. I would like to thank my parents-in-law, Alh Bala Launi, and Hajiya Fatima Abdullahi, for their love and encouragement. I really appreciated it, and may Allah SWA reward you with Jannatul Firdaus Amin.

Thank you very much to my lab mates Mohamed Redzuan bin Abbas and Song Yu Qing, who have always been there to assist me despite having a heavy workload and their own tasks to investigate. I also want to take this opportunity to thank all the staff of the Department of Biosciences (T02), the Faculty of Science, for their cooperation and assistance. I would also like to say a big thank you to Dr Murtala Liman, Dr Aliyu Chikaji and Family, Dr Maryam Ibrahim, and Family (Iman and Ihsan), Dr Sulaiman Muhammad, Dr Jibrin Ndejiko and Dr Oyewusi Habeebat Adekilekun.

Finally, I am very grateful to my family and friends for your love, support, and prayer in my years of study. Thanks to my dear grandma, Hajiya Umma Aishatu and my brothers and sisters for giving me encouragement and prayers throughout my years of study. Well, thank you so much.

May Allah bless the above-mentioned personalities with success and honor in their lives.

ABSTRACT

Arsenic (As) is an increasing threat across the globe, widely known as a threshold carcinogen, and it is reaching harmful values in several areas of the world. In this present study, the effect of *Microbacterium foliorum* strain SZ1, a plant growth promoting bacteria (PGPB) on inorganic As (arsenate) phytoremediation by *Melastoma malabathricum* L. plants were investigated through morphological, histological analysis and proteomic profiling. The experiments included a control treatment (*M. malabathricum* L. plants without As and bacterial inoculation) and two phytoremediation treatments, *M. malabathricum* L. in As contaminated soil inoculated or uninoculated with *M. foliorum* strain SZ1. The morphological parameter and phytoremediation potential induced by *M. foliorum* strain SZ1 on *M. malabathricum* L. were observed for 90 days. Besides, the histological and proteome analysis was conducted using Transmission Electron Microscopy (TEM) and 2-Dimensional gel electrophoresis (2-DE), respectively. The present study showed that plants did not display any noticeable signs of toxicity, but rather the root and shoot length were significantly increased in the presence of *M. foliorum* strain SZ1. In addition, while the Bioconcentration factor (BCF) was increased in the presence of *M. foliorum* strain SZ1 by 0.3 times, the Transfer factor (TF) of As in the *M. malabathricum* L. plants were decreased, whether in the presence or absence of PGPB. The As phytoremediation treatment with *M. foliorum* strain SZ1 also enhanced uptake of As in root (26%) and shoot (22%) than in the other two phytoremediation treatments (As only and control). The findings showed that *M. foliorum* strain SZ1 inoculation reduced As toxicity by substantially reducing the negative stress effects and increasing shoot and root fresh and dry weight. The repair of As induced structural deformities involving disintegration of cell wall and membranes were observed upon *M. foliorum* strain SZ1 inoculation. After PD-Quest analysis, 9 differentially expressed spots subjected to liquid chromatography-tandem mass spectrometry and 9 spots identified with a significant score. The up regulation of tubulin, nucleoside diphosphate kinase and major allergen during As with bacteria exposure confirmed the amelioration of As induced oxidative stress. The abundance of proteins involved in photosynthesis, energy metabolism, defence, signaling, protein biogenesis and nucleoside *M. malabathricum* L. were found higher in As with bacteria than in As alone exposure. Overall, the present study demonstrates the effectiveness of phytoremediation by *M. foliorum* strain SZ1 on responsive pathways including morphology, histology and proteomic of *M. malabathricum* L. plant.

ABSTRAK

Arsenik (As) merupakan ancaman yang semakin meningkat di seluruh dunia, dikenali secara meluas sebagai karsinogen ambang, dan ia mencapai nilai berbahaya di beberapa kawasan di dunia. Dalam kajian ini, kesan bakteria penggalak pertumbuhan tanaman (PGPB) terhadap fitopemulihan As bukan organik (arsenat) oleh *Melastoma malabathricum* L. disiasat melalui analisis morfologi, histologi dan profil proteomik. Eksperimen tersebut merangkumi rawatan kawalan (tanaman *M. malabathricum* L. tanpa As dan inokulasi bakteria) dan dua rawatan fitopemulihan, (*M. malabathricum* L. dalam tanah yang tercemar As, diinokulasi dengan *M. foliorum* strain SZ1 serta tanpa inokulasi mikrob. Parameter morfologi dan potensi fitopemulihan yang disebabkan oleh *M. foliorum* strain SZ1 pada *M. malabathricum* L. dinilai dalam masa 90 hari. Selain itu, analisis histologi dan proteom dilakukan dengan menggunakan mikroskop elektron transmisi (TEM) dan elektroforesis gel 2-dimensi (2-DE). Kajian ini menunjukkan bahawa tumbuhan tidak menunjukkan tanda-tanda ketoksikan yang ketara, tetapi panjang akar dan batangnya meningkat dengan ketara dengan kehadiran *M. foliorum* strain SZ1. Di samping itu, sementara faktor biokonsentrasi (BCF) meningkat dengan kehadiran *M. foliorum* strain SZ1, faktor pemindah (TF) As pada tanaman *M. malabathricum* L. menurun, sama ada dengan kehadiran atau ketiadaan PGPB. Rawatan fitopemulihan dengan *M. foliorum* strain SZ1 juga meningkatkan pengambilan As dalam akar dan pucuk daripada dua rawatan fitopemulihan yang lain. Pembaikan kecacatan struktur yang disebabkan oleh As yang melibatkan perpecahan dinding sel dan membran diperhatikan semasa inokulasi *M. foliorum* strain SZ1. Kajian ini menunjukkan bahawa inokulasi *M. foliorum* strain SZ1 mengurangkan toksik As dengan cara mengurangkan tekanan negatif secara ketara dan meningkatkan berat kering pucuk dan akar segar. Selepas analisis PD-quest, 9 bintik yang dinyatakan berbeza dikenakan spektrometri massa kromatografi cair dan 9 titik yang dikenal pasti mempunyai skor yang signifikan. Strain yang tergolong dalam spesies *M. foliorum* strain SZ1 terkenal dengan kemampuannya menghasilkan siderofor yang bersinergi dengan akar tanaman dapat mempengaruhi kadar mobilisasi arsenat-ke-arsenit, pengambilan dan translokasi As secara efektif. Peraturan tubulin, nukleosida difosfat kinase dan alergen utama semasa pendedahan bakteria As mengesahkan peningkatan tekanan oksidatif yang disebabkan As. Protein yang terlibat dalam fotosintesis, metabolisma tenaga, pertahanan, isyarat, biogenesis protein dan nukleosida *M. malabathricum* L. didapati lebih tinggi pada bakteria di dalam As daripada pendedahan As sahaja. Secara keseluruhan, hasil kajian ini menunjukkan keberkesanan fitopemulihan oleh *M. foliorum* strain SZ1 terhadap laluan tindakbalas dari segi morfologi, histologi dan protein dalam tumbuhan *M. malabathricum* L.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

As	-	Arsenic
As (V)	-	Arsenate
As (III)	-	Arsenite
Fe	-	Iron
Zn	-	Zinc
Cu	-	Copper
Cd	-	Cadmium
Cr	-	Chromium
Pb	-	Lead
Hg	-	Mercury
N_2	-	Nitrogen
Pst	-	Phosphate specific transport
Pit	-	Inorganic phosphate transport
ROS	-	Reactive oxygen species
ATP	-	Adenosine triphosphate
GLpF	-	Aquaglyceroporin
SAM	-	S-adenosyl methionine
GSH	-	Glutathione
TMA	-	Trimethylarsine
TMAO	-	Trimethylarsine Oxide
DNA	-	Deoxyribonucleic acid
ACC	-	aminocyclopropane-1-carboxylic acid
PGPE	-	Plant growth promoting endophytic bacteria
PGPR	-	Plant growth promoting rhizospheric bacteria
ISR	-	Induced disease resistance

LIST OF SYMBOLS

<	-	Smaller than
>	-	Greater than
°C	-	Degree Celsius
cm	-	Centimetres
Eh	-	Redox potential
g	-	Gram
gL^{-1}		Gram per litre
H^+		Hydrogen ion
M		Molar
ml		Millilitre
Mm		Millimetre
Ppm		Part per million
v/v		Volume per volume

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Problem Background

Arsenic (As) contamination of the environment is fast becoming a global problem originating from anthropogenic activities such as urbanization, metal mining, rapid industrialization, and other agrochemicals (Chauhan *et al.*, 2020). Mining activities and various heavy industries are important economic sources for Malaysia, with most of the urban regions and industries found in the western part of the country (Ahmadpour *et al.*, 2012; Rajoo *et al.*, 2013). The common origin of As contamination in Malaysian soils are pesticides, manufacturing industries, abandoned mining sites and inappropriate waste recycling. For example, Tasik Biru, formed from an open gold mining pit, contained a high level of As in the water (Bahari *et al.*, 2017a). Also, a report in a local newspaper revealed a high concentration of As in fishes caught in Sungai Pengorak traced to contamination by waste from bauxite mining in Pahang (Shah, 2015).

International Agency for Research on Cancer and the US Environmental Protection Agency classified arsenic as one of the most dangerous pollutants that is toxic to plants, animals, and human beings. The introduction of this toxic metalloid into the food chain poses long-term risks to human health (Mandal and Suzuki, 2002). Long-term exposure to As can cause genetic variation that can lead to cancers of the skin, lung, and kidney (Flora *et al*., 2020). About 70 countries and over 150 million people worldwide living in rural areas have been exposed to As through groundwater supplies for many decades (Shankar and Shanker, 2014). Having understood the global problem associated with As contamination and its effect on the global economy and civilization, its concentration from soil and water becomes a primary ecological necessity and concern.

Phytobial remediation implies the combination of microorganisms and plants to reduce the level of heavy metals in soil. The bacteria play an essential role in the ecosystem; they create stable microbial communities that derive significant biogeochemical processes, assist growth in plants and assist in taking up toxic material (Van Der Heijden *et al.*, 2008). These mutual associations can help plants to overcome As-toxicity through development of an antioxidant resistance system and the compartmentalization of thiolated arsenic conjugates (decreasing the amount of free-As) with the help of glutathione (GSH) (Santoyo *et al.*, 2016). These mechanisms help to avoid and overcome damages triggered by As-instigated oxidative stress (Meharg and Hartley-Whitaker, 2002). This process initiates differentiated regulation of proteins, for example, enzymes that catalyze GSH metabolism and ascorbate-glutathione (ASC-GSH) cycle become activated (Ahsan *et al.*, 2009; Requejo and Tena, 2006).

Melastoma malabathricum L. *(M. malabathricum)* is a type of hyper accumulative plant found in the south eastern part of Asian countries (Abdullah and Yong, 2007). They are habitually seen in the wooded area, lowland, and tropical acid soil. This plant can accumulate Al, As, Zn, Pb (Ashraf, 2013; Chua and Hashim, 2008; Yeo and Tan, 2011). It is called Pokok Senduduk in Malay, and it is generally used as a medicinal plant. Besides, it is a hyperaccumulator that tolerates heavy metals contaminants and yields enormous quantities of biomass (Selamat *et al*., 2014).

The combination of plants and microbes can improve the efficiency of phytoremediation. *Microbacterium foliorum* strain SZ1 (*M. foliorum*) is a genus of mycobacterium from family *Microbacteriaeceae*. *Microbacterium* has 96 species. They are gram-positive (Corretto *et al.*, 2015a), essential in agriculture, (Behrendt *et al*., 2001) and contribute a lot to the soil system. For example, they help the plant to fix nitrogen in the soil in exchange for plant saccharide (Behrendt *et al*., 2001). *M. foliorum* strain SZ1 is As resistance bacteria isolated in Malaysia from the ex-gold mining site, highly contaminated with As. These bacteria can tolerate As toxicity at a half-maximal inhibitory concentration (IC50) of 140 mM (Bahari *et al*., 2016).

Dark purple *M. malabathricum* L. was selected for this study as it was reported by different authors to have the capacity in accumulating heavy metals in substantial amount. The use of microbe-assisted bacteria and *M. malabathricum* for As removal and its effect on the physiological, biological and metabolic response of the plant are still at an early stage. Therefore, more studies are needed on the capacity of *M. malabathricum* to take up As when inoculated with bacteria. The aim of the study was to determine the effect of As on plant growth, morphology, uptake, phytoremediation potential and differential protein abundance when the plant is inoculated with the plant growth promoting bacterium.

1.2 Problem Statement

Many environmental studies have focused on the remediation of arsenic contamination in drinking water rather than soil. The high existence of arsenic contaminants in the soil highlights the necessity to search for more remediation strategies. In this context, phytobial remediation is not only an eco-friendly alternative to the conventional bioremediation strategies but also a viable and sustainable approach for the removal of arsenic pollutants from the soil. In the past, *M. malabathricum* L.was used to bioremediate other pollutants in the soil (Patek-Mohd *et al*., 2018; Mahmud and Burslem, 2020). Also, the phytotoxicity of varied levels of arsenic morphological, histological and proteomic changes, with *M. foliorum* strain SZ1 on the *M. malabathricum* L. species has not been researched, nor their roles in supporting the *M. malabathricum* L. phytoremediation of arsenic-polluted soils. *M. foliorum* strain SZ1 was selected for this study because it has been shown to grow in diverse environments, including soil with adverse conditions, plants, water, and humans (Corretto *et al.*, 2015b), while *M. malabathricum* L. is a plant that can accumulate different metals such as aluminium, lead, and copper (Selamat *et al.*, 2014; Watanabe *et al.*, 1998). The present study contributes to the growing knowledge of the phytobial remediation of contaminated soils through exploration of the potential of the *M. malabathricum* L. species as well as the possibilities of biologically assisted phytoremediation.

1.3 Research Objectives

The objectives of the research are:

(a) To determine the effects of *M. foliorum* strain SZ1 inoculation on plant growth and root histological characteristics of *M. malabathricum.*

(b) To determine the changes in As content in soil, leachate and plant tissues after inoculation of *M. foliorum* strain SZ1 on *M. malabathricum*.

(c) To determine the phytoremediation potential of *M. malabathricum*.

(d) To examine the changes in differential protein abundance in *M. malabathricum* inoculated with *M. foliorum* strain SZ1 using 2D-PAGE.

1.4 Significance of the Research

This study aims to develop a novel and sustainable bioremediation strategies that remediate contaminated soil using a combination of plants and plant growth promoting bacteria (PGPB). It also explores phytobial remediation as a more effective and sustainable method that allows assimilation of facts on the role played by arsenate-reducing bacteria in As transformation. The findings of this study will enable a better understanding of the use of phytobial remediation in enhancing morphology/ plant growth under As contamination that leads to changes in As speciation, root morphology and protein contents in plant tissue because of *M. foliorum* strain SZ1 inoculation. This research is of great benefit to Malaysia and other countries on their efforts to reduce As contamination, and this will be improved significantly to meet the current standard of Arsenic level worldwide. This study is the first to report on the use of *M. foliorum* strain SZ1 inoculation on *Melastoma malabathricum* L.to reduce a certain level of As contamination.

1.5 Scope of the Research

The present research provides insight into As treatment using phytobial (plant and bacteria) approach. Arsenate was selected because it is the most common arsenic species in soil (Ma *et al.*, 2001). *M. malabathricum* able to survive in arsenic-contaminated soil up to 2,800 ppm (Selamat *et al*., 2014). The three months old plants were inoculated with *M. foliorum* strain SZ1 that was previously isolated from a gold ex-mining site in Johor. There were four treatments of As in the respective amended soil: 0, 50 and 70 ppm. Each treatment was replicated four times, with a total of 88 pots. The attesting As reducing microbes were inoculated on the plant-soil to compare their treatment efficiency. The containers were arranged in a Randomized Complete Block Design (RCBD) in a greenhouse. Pot experiments were conducted by inoculating the *M. foliorum* strain SZ1. Plant harvested after three months of treatment, and morphological, histological observation and proteome profiling were determined.

The morphological properties of plants were investigated by measuring/ observing plant growth/ length, root length, leaf length, shoot length, fresh and dry weight of root and shoot. In addition, histological observations using Transmission Electron Microscopy (TEM) was conducted with the focus on root tissue as it is the closest part of the plants that directly interact with the soil community. Previous study reported the ability of *Melastoma malabathricum* L. roots to take up more As than other parts of the plants. The plant and soil As content were determined using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS, Agilent Technologies). The phytoremediation potential was determined by phytoremediation capacity by studying arsenic content in tissues/ leachate/ soil to get the uptake level using the Bioconcentration factor (BCF) and Transfer Factor (TF). Changes in differentially displayed proteins in roots were studied by using two-dimensional sodium dodecyl sulfate polyacrylamide gel electrophoresis (2D SDS-PAGE), followed by liquid chromatography- mass spectrometry (LC/MSMS).

REFERENCES

Abbas, G., Murtaza, B., Bibi, I., Shahid, M., Niazi, N. K., Khan, M. I., Amjad, M. & Hussain, M. (2018). Arsenic uptake, toxicity, detoxification, and speciation in plants: physiological, biochemical, and molecular aspects. *International Journal of Environmental Research and Public Health*, *15*(1), 59.

Abdullah, J. O., & Yong, W. T. L. (2007). Melastomataceae: inherent economical values substantiating potential transgenic studies in the family. *Transgenic Plant Journal*, *1*(1), 237-43.

Abedin, M. J., Cresser, M. S., Meharg, A. A., Feldmann, J., & Cotter-Howells, J. (2002). Arsenic accumulation and metabolism in rice (Oryza sativa L.). *Environmental Science & Technology*, *36*(5), 962-968.

Afzal, I., Shinwari, Z. K., Sikandar, S., & Shahzad, S. (2019). Plant beneficial endophytic bacteria: Mechanisms, diversity, host range and genetic determinants. *Microbiological Research*, *221*, 36-49.

Affandi, F. A., & Ishak, M. Y. (2018). Heavy metal concentrations in tin mine effluents in Kepayang River, Perak, Malaysia. *Journal of Physical Science*, *29*, 81-86.

Agrawal, L., Gupta, S., Mishra, S. K., Pandey, G., Kumar, S., Chauhan, P. S., Chakrabarty, D.& Nautiyal, C. S. (2016). Elucidation of complex nature of PEG induced drought-stress response in rice root using comparative proteomics approach. *Frontiers in Plant Science*, *7*, 1466.

Aguilar-Galvez, A., Pedreschi, R., Carpentier, S., Chirinos, R., García-Ríos, D., & Campos, D. (2020). Proteomic analysis of mashua (Tropaeolum tuberosum) tubers subjected to postharvest treatments. *Food Chemistry*, *305*, 125485.

Ahmad, P., Alam, P., Balawi, T. H., Altalayan, F. H., Ahanger, M. A., & Ashraf, M. (2020). Sodium nitroprusside (SNP) improves tolerance to arsenic (As) toxicity in Vicia faba through the modifications of biochemical attributes, antioxidants, ascorbate-glutathione cycle and glyoxalase cycle. *Chemosphere*, *244*, 125480.

Ahmadpour, P., Ahmadpour, F., Mahmud, T. M. M., Abdu, A., Soleimani, M., & Tayefeh, F. H. (2012). Phytoremediation of heavy metals: A green technology. *African Journal of Biotechnology*, *11*(76), 14036-14043.

Ahsan, N., Lee, D. G., Alam, I., Kim, P. J., Lee, J. J., Ahn, Y. O., Kwak, S.S., Lee, I.J., Bahk, J.D., Kang, K.Y. & Renaut, J. (2008). Comparative proteomic study of arsenic-induced differentially expressed proteins in rice roots reveals glutathione plays a central role during As stress. *Proteomics*, *8*(17), 3561-3576.

Ahsan, N., Nanjo, Y., Sawada, H., Kohno, Y., & Komatsu, S. (2010). Ozone stress-induced proteomic changes in leaf total soluble and chloroplast proteins of soybean reveal that carbon allocation is involved in adaptation in the early developmental stage. *Proteomics*, *10*(14), 2605-2619.

Ahsan, N., Renaut, J., & Komatsu, S. (2009). Recent developments in the application of proteomics to the analysis of plant responses to heavy metals. *Proteomics*, *9*(10), 2602-2621.

Akhtar, S., & Shoaib, A. (2014). Toxic effect of arsenate on germination, early growth and bioaccumulation in wheat (Triticum aestivum L.). *Pakistan Journal of Agricultural Sciences*, *51*(2).

Alcántara-Martínez, N., Figueroa-Martínez, F., Rivera-Cabrera, F., Gutiérrez-Sánchez, G., & Volke-Sepúlveda, T. (2018). An endophytic strain of Methylobacterium sp. increases arsenate tolerance in Acacia farnesiana (L.) Willd: A proteomic approach. *Science of The Total Environment*, *625*, 762-774.

Alcantara-Martinez, N., Guizar, S., Rivera-Cabrera, F., Anicacio-Acevedo, B. E., Buendia-Gonzalez, L., & Volke-Sepulveda, T. (2016). Tolerance, arsenic uptake, and oxidative stress in Acacia farnesiana under arsenate-stress. *International Journal of Phytoremediation*, *18*(7), 671-678.

Ali, B., Huang, C. R., Qi, Z. Y., Ali, S., Daud, M. K., Geng, X. X., Liu, H.B. & Zhou, W. J. (2013). 5-Aminolevulinic acid ameliorates cadmium-induced morphological, biochemical, and ultrastructural changes in seedlings of oilseed rape. *Environmental Science and Pollution Research*, *20*(10), 7256-7267.

Ali, H., Khan, E., & Sajad, M. A. (2013). Phytoremediation of heavy metals—concepts and applications. *Chemosphere*, *91*(7), 869-881.

Ali, I., Asim, M., & Khan, T. A. (2013). Arsenite removal from water by electro-coagulation on zinc–zinc and copper–copper electrodes. *International Journal of Environmental Science and Technology*, *10*(2), 377-384.

Ali, Q., Daud, M. K., Haider, M. Z., Ali, S., Rizwan, M., Aslam, N., Noman, A., Iqbal, N., Shahzad, F., Deeba, F.& Ali, I. (2017). Seed priming by sodium nitroprusside improves salt tolerance in wheat (Triticum aestivum L.) by enhancing physiological and biochemical parameters. *Plant Physiology and Biochemistry*, *119*, 50-58.

Ali, W., Rasool, A., Junaid, M., & Zhang, H. (2019). A comprehensive review on current status, mechanism, and possible sources of arsenic contamination in groundwater: a global perspective with prominence of Pakistan scenario. *Environmental Geochemistry and Health*, *41*(2), 737-760.

Alka, S., Shahir, S., Ibrahim, N., Chai, T. T., Bahari, Z. M., & Abd Manan, F. (2020). The role of plant growth promoting bacteria on arsenic removal: A review of existing perspectives. *Environmental Technology & Innovation*, *17*, 100602.

Alkurdi, S. S., Herath, I., Bundschuh, J., Al-Juboori, R. A., Vithanage, M., & Mohan, D. (2019). Biochar versus bone char for a sustainable inorganic arsenic mitigation in water: What needs to be done in future research?. *Environment International*, *127*, 52-69.

Andrade, L. H., Pires, W. L., Grossi, L. B., Aguiar, A. O., & Amaral, M. C. (2019). Integration of two-stage nanofiltration with arsenic and calcium intermediate chemical precipitation for gold mining effluent treatment. *Environmental Technology*, *40*(13), 1644-1656.

Anjum, S. A., Tanveer, M., Hussain, S., Ashraf, U., Khan, I., & Wang, L. (2017). Alteration in growth, leaf gas exchange, and photosynthetic pigments of maize plants under combined cadmium and arsenic stress. *Water, Air, & Soil Pollution*, 228(1), 13.

Antoniadis, V., Levizou, E., Shaheen, S. M., Ok, Y. S., Sebastian, A., Baum, C., Prasad, M.N., Wenzel, W.W. & Rinklebe, J. (2017). Trace elements in the soil-plant interface: Phytoavailability, translocation, and phytoremediation–A review. *Earth-Science Reviews*, *171*, 621-645.

Anwar, S., Khan, S., Ashraf, M. Y., Noman, A., Zafar, S., Liu, L., Liu, L., Ullah, S. & Fahad, S. (2017). Impact of chelator-induced phytoextraction of cadmium on yield and ionic uptake of maize. *International Journal of Phytoremediation*, *19*(6), 505-513.

Arunakumara, K. K. I. U., Walpola, B. C., Song, J. S., Shin, M. J., Lee, C. J., & Yoon, M. H. (2014). Phytoextraction of heavy metals induced by bioaugmentation of a phosphate solubilizing bacterium. *Korean Journal of Environmental Agriculture*, *33*(3), 220-230.

Arslan, M., Imran, A., Khan, Q. M., & Afzal, M. (2017). Plant–bacteria partnerships for the remediation of persistent organic pollutants. *Environmental Science and Pollution Research*, *24*(5), 4322-4336.

Arzanesh, M. H., Alikhani, H. A., Khavazi, K., Rahimian, H. A., & Miransari, M. (2011). Wheat (Triticum aestivum L.) growth enhancement by Azospirillum sp. under drought stress. *World Journal of Microbiology and Biotechnology*, *27*(2), 197-205.

Asad, S. A., Farooq, M., Afzal, A., & West, H. (2019). Integrated phytobial heavy metal remediation strategies for a sustainable clean environment-a review. *Chemosphere*, *217*, 925-941.

Asada, K., Kiso, K., & Yoshikawa, K. (1974). Univalent reduction of molecular oxygen by spinach chloroplasts on illumination. *Journal of Biological Chemistry*, *249*(7), 2175-2181.

Ashraf, M. A., Hussain, I., Rasheed, R., Iqbal, M., Riaz, M., & Arif, M. S. (2017). Advances in microbe-assisted reclamation of heavy metal contaminated soils over the last decade: a review. *Journal of Environmental Management*, *198*, 132-143.

Ashraf, M. A., Maah, M. J., & Yusoff, I. (2013). Evaluation of natural phytoremediation process occurring at ex-tin mining catchment. *Chiang Mai Journal of Science*, *40*(2), 198-213.

Ashraf, M. A., Maah, M. J., & Yusoff, I. B. (2010). Study of water quality and heavy metals in soil & water of ex-mining area Bestari Jaya, peninsular Malaysia. *International Journal of Basic & Applied Sciences IJBAS-IJENS*, *10*(03), 7-23.

Ashraf, M. A., Riaz, M., Arif, M. S., Rasheed, R., Iqbal, M., Hussain, I., & Mubarik, M. S. (2019). The role of non-enzymatic antioxidants in improving abiotic stress tolerance in plants. In *Plant Tolerance to Environmental Stress* (pp. 129-144). CRC Press.

Atsdr, U. (2007). Toxicological profile for arsenic. Agency for Toxic Substances and Disease Registry, Division of Toxicology, Atlanta, GA.

Augusta, A. C., Bertha, E. E. C., & Eromosele, A. S. (2022). Plant-Microbe Interaction: Prospects and Applications in Sustainable Environmental Management.

Awasthi, S., Chauhan, R., Dwivedi, S., Srivastava, S., Srivastava, S., & Tripathi, R. D. (2018). A consortium of alga (Chlorella vulgaris) and bacterium (Pseudomonas putida) for amelioration of arsenic toxicity in rice: A promising and feasible approach. *Environmental and Experimental Botany*, *150*, 115-126.

Aziz, N., Nor, N. M., & Arof, A. K. (2020). Optimization of anthocyanin extraction parameters from Melastoma malabathricum L.via response surface methodology to produce natural sensitizer for dye sensitized solar cells. *Optical and Quantum Electronics*, *52*(1), 24.

Bahari, Z. M., Ibrahim, Z., Jaafar, J., & Shahir, S. (2017). Draft Genome Sequence of Arsenic-Resistant Microbacterium sp. Strain SZ1 Isolated from Arsenic-Bearing Gold Ores. *Genome Announcements*, *5*(43).

Baker, A. J., & Whiting, S. N. (2002). In search of the Holy Grail–a further step in understanding metal hyperaccumulation?. *New Phytologist*, *155*(1), 1-4.

Barberini, L., Noto, A., Saba, L., Palmas, F., Fanos, V., Dessì, A., Zavattoni, M., Fattuoni, C. & Mussap, M. (2016). Multivariate data validation for investigating primary HCMV infection in pregnancy. *Data in brief*, *9*, 220-230.

Bat, L., Şahin, F., Bhuyan, M., Arici, E., & Öztekin, A. (2022). Metals in Wild and Cultured Dicentrarchus labrax (Linnaeus, 1758) from Fish Markets in Sinop: Consumer's Health Risk Assessment. *Biological Trace Element Research*, 1-9.

Behrendt, U., Ulrich, A., & Schumann, P. (2001). Description of Microbacterium foliorum sp. nov. and Microbacterium phyllosphaerae sp. nov., isolated from the phyllosphere of grasses and the surface litter after mulching the sward, and reclassification of Aureobacterium resistens (Funke *et al*. 1998) as Microbacterium resistens comb. nov.. *International Journal of Systematic and Evolutionary Microbiology*, *51*(4), 1267-1276.

Bhattacharjee, H., and B. P. Rosen. (2007). Arsenic Metabolism in Prokaryotic and Eukaryotic Microbes *Molecular Microbiology of Heavy Metals* (pp. 371-406): Springer.

Bhattacharyya, C., Bakshi, U., Mallick, I., Mukherji, S., Bera, B., & Ghosh, A. (2017). Genome-guided insights into the plant growth promotion capabilities of the physiologically versatile Bacillus aryabhattai strain AB211. *Frontiers in Microbiology*, *8*, 411.

Bijlsma, S., Bobeldijk, I., Verheij, E. R., Ramaker, R., Kochhar, S., Macdonald, I. A., Van Ommen, B. & Smilde, A. K. (2006). Large-scale human metabolomics studies: a strategy for data (pre-) processing and validation. *Analytical Chemistry*, *78*(2), 567-574.

Bilal, S., Shahzad, R., Khan, A. L., Kang, S. M., Imran, Q. M., Al-Harrasi, A., Yun, B.W. & Lee, I. J. (2018). Endophytic microbial consortia of phytohormones-producing fungus Paecilomyces formosus LHL10 and bacteria Sphingomonas sp. LK11 to Glycine max L. regulates physio-hormonal changes to attenuate aluminum and zinc stresses. *Frontiers in Plant Science*, *9*, 1273.

Bilal, S., Shahzad, R., Khan, A. L., Al-Harrasi, A., Kim, C. K., & Lee, I. J. (2019). Phytohormones enabled endophytic Penicillium funiculosum LHL06 protects Glycine max L. from synergistic toxicity of heavy metals by hormonal and stress-responsive proteins modulation. *Journal of Hazardous Materials*, *379*, 120824.

Bona, E., Cattaneo, C., Cesaro, P., Marsano, F., Lingua, G., Cavaletto, M., & Berta, G. (2010). Proteomic analysis of Pteris vittata fronds: two arbuscular mycorrhizal fungi differentially modulate protein expression under arsenic contamination. *Proteomics*, *10*(21), 3811-3834.

Bona, E., Scarafoni, A., Marsano, F., Boatti, L., Copetta, A., Massa, N., Gamalero, E., D'Agostino, G., Cesaro, P., Cavaletto, M. & Berta, G. (2016). Arbuscular mycorrhizal symbiosis affects the grain proteome of Zea mays: a field study. *Scientific Reports*, *6*, 26439.

Bonfig, K. B., Schreiber, U., Gabler, A., Roitsch, T., & Berger, S. (2006). Infection with virulent and avirulent P. syringae strains differentially affects photosynthesis and sink metabolism in Arabidopsis leaves. *Planta*, *225*(1), 1-12.

Borges, K. L. R., Salvato, F., Alcântara, B. K., Nalin, R. S., Piotto, F. Â., & Azevedo, R. A. (2018). Temporal dynamic responses of roots in contrasting tomato genotypes to cadmium tolerance. *Ecotoxicology, 27*(3), 245-258.

Brennan, A., Jiménez, E. M., Puschenreiter, M., Alburquerque, J. A., & Switzer, C. (2014). Effects of biochar amendment on root traits and contaminant availability of maize plants in a copper and arsenic impacted soil. *Plant and Soil, 379*(1-2), 351-360.

Burges, A., Alkorta, I., Epelde, L., & Garbisu, C. (2018). From phytoremediation of soil contaminants to phytomanagement of ecosystem services in metal contaminated sites. *International Journal of Phytoremediation*, *20*(4), 384-397.

Çakmakçı, R., Turan, M., Kıtır, N., Güneş, A., Nikerel, E., Özdemir, B. S., Yıldırım, E., Olgun, M., Topçuoğlu, B., Tüfenkçi, Ş. & Karaman, M. R. (2017). The role of soil beneficial bacteria in wheat production: a review. *Wheat Improvement, Management and Utilization, eds. R. Wanyera and J. Owuoche*, 115-149.

Calba, H., Cazevieille, P., Thée, C., & Poss, R. (2004). The dynamics of protons, aluminium, and calcium in the rhizosphere of maize cultivated in tropical acid soils: experimental study and modelling. *Plant and Soil, 260*(1-2), 33-46.

Canatto, R. A., de Oliveira, J. A., da-Silva, C. J., & Albino, B. É. S. (2021). Tolerance of Landoltia punctata to arsenate: an evaluation of the potential use in phytoremediation programs. *International Journal of Phytoremediation*, *23*(1), 102-110.

Cárdenas-Aguiar, E., Suárez, G., Paz-Ferreiro, J., Askeland, M. P. J., Méndez, A., & Gascó, G. (2020). Remediation of mining soils by combining Brassica napus growth and amendment with chars from manure waste. *Chemosphere, 261*, 127798.

Cavalca, L., Zanchi, R., Corsini, A., Colombo, M., Romagnoli, C., Canzi, E., & Andreoni, V. (2010). Arsenic-resistant bacteria associated with roots of the wild Cirsium arvense (L.) plant from an arsenic polluted soil, and screening of potential plant growth-promoting characteristics. *Systematic and Applied Microbiology, 33*(3), 154-164.

Chaignon, V., Bedin, F., & Hinsinger, P. (2002). Copper bioavailability and rhizosphere pH changes as affected by nitrogen supply for tomato and oilseed rape cropped on an acidic and a calcareous soil. *Plant and Soil, 243*(2), 219-228.

Chandra, S., Saha, R., & Pal, P. (2016). Arsenic uptake and accumulation in okra (Abelmoschus esculentus) as affected by different arsenical speciation. *Bulletin of Environmental Contamination and Toxicology*, *96*(3), 395-400.

Chandrakar, V. I. B. H. U. T. I., & Keshavkant, S. (2018). Growth and metabolic responses of Glycine max L. to arsenate and arsenite: a comparative assessment. *Bangladesh Journal of Botany*, *47*, 105-113.

Chandrakar, V., Naithani, S. C., & Keshavkant, S. (2016). Arsenic-induced metabolic disturbances and their mitigation mechanisms in crop plants: A review. *Biologia*, *71*(4), 367-377.

Chandrasekhar, C., & Ray, J. G. (2019). Lead accumulation, growth responses and biochemical changes of three plant species exposed to soil amended with different concentrations of lead nitrate. *Ecotoxicology and Environmental Safety*, *171*, 26-36.

Chatterjee, S., Moogoui, R., & Gupta, D. K. (2017). Arsenic: Source, occurrence, cycle, and detection. In *Arsenic Contamination in the Environment* (pp. 13-35). Springer, Cham.

Chauhan, R., Awasthi, S., Indoliya, Y., Chauhan, A. S., Mishra, S., Agrawal, L., Srivastava, S., Dwivedi, S., Singh, P.C., Mallick, S. & Chauhan, P. S. (2020). Transcriptome and proteome analyses reveal selenium mediated amelioration of arsenic toxicity in rice (Oryza sativa L.). *Journal of Hazardous Materials*, *390*, 122122.

Chen, B., Shen, J., Zhang, X., Pan, F., Yang, X., & Feng, Y. (2014). The endophytic bacterium, Sphingomonas SaMR12, improves the potential for zinc phytoremediation by its host, Sedum alfredii. *PLoS One*, *9*(9), e106826.

Chen, H., Zhao, T., Sun, D., Wu, M., & Zhang, Z. (2019). Changes of RNA N6-methyladenosine in the hormesis effect induced by arsenite on human keratinocyte cells. *Toxicology in Vitro*, *56*, 84-92.

Chen, T., Bao, N., Wang, Y., & Liu, Y. (2020). Effects of exogenous phosphorus input on growth and arsenic accumulation in Typha angustifolia L. contaminated by arsenic. *Journal of Southern Agriculture*, *51*(9), 2104-2112.

Chen, Y., Cao, Y., Rathinasabapathi, B., & Ma, L. (2018). Novel genes of Hyperaccumulator ferns in arsenic tolerance, uptake, and metabolism: implications for crop improvement. In *Current Advances in Fern Research* (pp. 361-379). Springer, Cham.

Chen, Z., Zheng, Y., Ding, C., Ren, X., Yuan, J., Sun, F., & Li, Y. (2017). Integrated metagenomics and molecular ecological network analysis of bacterial community composition during the phytoremediation of cadmium-contaminated soils by bioenergy crops. *Ecotoxicology and Environmental Safety*, *145*, 111-118.

Cheng, Y., Nathanail, C. P., & Ja'afaru, S. W. (2019). Generic assessment criteria for human health risk management of agricultural land scenario in Jiangsu Province, China. *Science of The Total Environment*, *697,* 134071.

Chidambaram, A., Murugan, A., Ganesh, K. S., & Sundaramoorthy, P. (2006). Effect of chromium on growth and cell division of blackgram [Vigna mungo (L.) Hepper]. *Plant Archives, 6*(2), 763-766.

Chiu, V. Q., & Hering, J. G. (2000). Arsenic adsorption and oxidation at manganite surfaces. 1. Method for simultaneous determination of adsorbed and dissolved arsenic species. *Environmental Science & Technology, 34*(10), 2029-2034.

Chua, S. Y., & Hashim, N. R. (2008). Heavy metal concentrations in the soils and shrubs near a metal processing plant in Peninsular Malaysia. *The Icfai Journal of Environmental Sciences*, *2*(2), 19-29.

Choudhary, D. K., & Varma, A. (Eds.). (2016). *Microbial-mediated induced systemic resistance in plants*. New York: Springer.

Comparot, S., Lingiah, G., & Martin, T. (2003). Function and specificity of 14-3-3 proteins in the regulation of carbohydrate and nitrogen metabolism. *Journal of Experimental Botany*, *54*(382), 595-604.

Corretto, E., Antonielli, L., Sessitsch, A., Kidd, P., Weyens, N., & Brader, G. (2015). Draft genome sequences of 10 Microbacterium spp., with emphasis on heavy metal-contaminated environments. *Genome Announcements, 3*(3): e00432-00415.

Cox, M. S., Bell, P. F., & Kovar, J. L. (1996). Differential tolerance of canola to arsenic when grown hydroponically or in soil. *Journal of Plant Nutrition*, *19*(12), 1599-1610.

Cuebas, M., Sannino, D., & Bini, E. (2011). Isolation and characterization of arsenic resistant Geobacillus kaustophilus strain from geothermal soils. *Journal of Basic Microbiology*, *51*(4), 364-371.

Cui, J., Li, Y., Jin, Q., & Li, F. (2020). Silica nanoparticles inhibit arsenic uptake into rice suspension cells via improving pectin synthesis and the mechanical force of the cell wall. *Environmental Science: Nano*, *7*(1), 162-171.

da Silva, E. B., de Oliveira, L. M., Wilkie, A. C., Liu, Y., & Ma, L. Q. (2018). Arsenic removal from As-hyperaccumulator Pteris vittata biomass: coupling extraction with precipitation. *Chemosphere*, *193*, 288-294.

Das, J., & Sarkar, P. (2018). Remediation of arsenic in mung bean (Vigna radiata) with growth enhancement by unique arsenic-resistant bacterium Acinetobacter lwoffii. *Science of the Total Environment*, *624*, 1106-1118.

Das, S., Jean, J. S., Chou, M. L., Rathod, J., & Liu, C. C. (2016). Arsenite-oxidizing bacteria exhibiting plant growth promoting traits isolated from the rhizosphere of Oryza sativa L.: implications for mitigation of arsenic contamination in paddies. *Journal of Hazardous Materials*, *302*, 10-18.

Das, S., Jean, J. S., Kar, S., Chou, M. L., & Chen, C. Y. (2014). Screening of plant growth-promoting traits in arsenic-resistant bacteria isolated from agricultural soil and their potential implication for arsenic bioremediation. *Journal of Hazardous Materials*, *272*, 112-120.

De-Bashan, L. E., Hernandez, J. P., Bashan, Y., & Maier, R. M. (2010). Bacillus pumilus ES4: candidate plant growth-promoting bacterium to enhance establishment of plants in mine tailings. *Environmental and Experimental Botany*, *69*(3), 343-352.

de Andrade, F. M., de Assis Pereira, T., Souza, T. P., Guimarães, P. H. S., Martins, A. D., Schwan, R. F., Martins, A.D., Schwan, R.F., Pasqual, M. & Dória, J. (2019). Beneficial effects of inoculation of growth-promoting bacteria in strawberry. *Microbiological Research*, *223*, 120-128.

de Souza, T. D., Borges, A. C., Braga, A. F., Veloso, R. W., & de Matos, A. T. (2019). Phytoremediation of arsenic-contaminated water by Lemna Valdiviana: An optimization study. *Chemosphere*, *234*, 402-408.

Dehbandi, R., Abbasnejad, A., Karimi, Z., Herath, I., & Bundschuh, J. (2019). Hydrogeochemical controls on arsenic mobility in an arid inland basin, Southeast of Iran: The role of alkaline conditions and salt water intrusion. *Environmental Pollution*.

Dell'Amico, E., Cavalca, L., & Andreoni, V. (2008). Improvement of Brassica napus growth under cadmium stress by cadmium-resistant rhizobacteria. *Soil Biology and Biochemistry*, *40*(1), 74-84.

Delnomdedieu, M., Basti, M. M., Otvos, J. D., & Thomas, D. J. (1994). Reduction and binding of arsenate and dimethylarsinate by glutathione: a magnetic resonance study. *Chemico-Biological Interactions*, *90*(2), 139-155.

del Rosario Cappellari, L., Santoro, M. V., Nievas, F., Giordano, W., & Banchio, E. (2013). Increase of secondary metabolite content in marigold by inoculation with plant growth-promoting rhizobacteria. *Applied Soil Ecology*, *70*, 16-22.

del Rosario Cappellari, L., Santoro, M. V., Schmidt, A., Gershenzon, J., & Banchio, E. (2019). Induction of essential oil production in Mentha x piperita by plant growth promoting bacteria was correlated with an increase in jasmonate and salicylate levels and a higher density of glandular trichomes. *Plant Physiology and Biochemistry*, *141*, 142-153.

Deng, L., Zeng, G., Fan, C., Lu, L., Chen, X., Chen, M., Wu, H., He, X. & He, Y. (2015). Response of rhizosphere microbial community structure and diversity to heavy metal co-pollution in arable soil. *Applied Microbiology and Biotechnology*, *99*(19), 8259-8269.

Desale, P., Patel, B., Singh, S., Malhotra, A., & Nawani, N. (2014). Plant growth promoting properties of Halobacillus sp. and Halomonas sp. in presence of salinity and heavy metals. *Journal of Basic Microbiology*, *54*(8), 781-791.

Dixit, G., Singh, A. P., Kumar, A., Dwivedi, S., Deeba, F., Kumar, S., Suman, S., Adhikari, B., Shukla, Y., Trivedi, P.K. Trivedi, P. K. (2015). Sulfur alleviates arsenic toxicity by reducing its accumulation and modulating proteome, amino acids and thiol metabolism in rice leaves. *Scientific Reports*, *5*, 16205.

Doherty, S. J., Tighe, M. K., & Wilson, S. C. (2017). Evaluation of amendments to reduce arsenic and antimony leaching from co-contaminated soils. *Chemosphere*, *174*, 208-217.

Đorđević, B., Neděla, V., Tihlaříková, E., Trojan, V., & Havel, L. (2019). Effects of copper and arsenic stress on the development of Norway spruce somatic embryos and their visualization with the environmental scanning electron microscope. *New Biotechnology*, *48*, 35-43.

Drewniak, L., Matlakowska, R., Rewerski, B., & Sklodowska, A. (2010). Arsenic release from gold mine rocks mediated by the activity of indigenous bacteria. *Hydrometallurgy*, *104*(3-4), 437-442.

Eke, P., Kumar, A., Sahu, K. P., Wakam, L. N., Sheoran, N., Ashajyothi, M., M., Patel, A. & Fekam, F. B. (2019). Endophytic bacteria of desert cactus (Euphorbia trigonas Mill) confer drought tolerance and induce growth promotion in tomato (Solanum lycopersicum L.). *Microbiological Research*, *228*, 126302.

El-Masri, H. A., Hong, T., Henning, C., Mendez Jr, W., Hudgens, E. E., Thomas, D. J., & Lee, J. S. (2018). Evaluation of a physiologically based pharmacokinetic (PBPK) model for inorganic arsenic exposure using data from two diverse human populations. *Environmental Health Perspectives, 126*(7), 077004.

Fan, X. Y., Liu, Y. J., Cai, Y. M., Wang, A. D., Xia, Y. Z., Hu, Y. J., Jiang, F.L. & Liu, Y. (2019). A mitochondria-targeted organic arsenical accelerates mitochondrial metabolic disorder and function injury. *Bioorganic & Medicinal Chemistry*, *27*(5), 760-768.

Fan, X. Y., Liu, Y. J., Chen, K., Jiang, F. L., Hu, Y. J., Liu, D., Liu, Y. & Ge, Y. S. (2018). Organic arsenicals target thioredoxin reductase followed by oxidative stress and mitochondrial dysfunction resulting in apoptosis. *European Journal of Medicinal Chemistry*, *143*, 1090-1102.

Fan, X. Y., Yuan, L., Wu, C., Liu, Y. J., Jiang, F. L., Hu, Y. J., & Liu, Y. (2018). Mitochondrial toxicity of organic arsenicals: membrane permeability transition pore opening and respiratory dysfunction. *Toxicology Research*, *7*(2), 191-200.

Fang, T., Lu, W., Cui, K., Li, J., Yang, K., Zhao, X., Liang, Y. & Li, H. (2019). Distribution, bioaccumulation and trophic transfer of trace metals in the food web of Chaohu Lake, Anhui, China. *Chemosphere*, *218*, 1122-1130.

Farooq, M. A., Gill, R. A., Ali, B., Wang, J., Islam, F., Ali, S., & Zhou, W. (2016). Subcellular distribution, modulation of antioxidant and stress-related genes response to arsenic in Brassica napus L. *Ecotoxicology*, *25*(2), 350-366.

Farooq, M. A., Islam, F., Yang, C., Nawaz, A., Gill, R. A., Ali, B., Song, W. & Zhou, W. (2018). Methyl jasmonate alleviates arsenic-induced oxidative damage and modulates the ascorbate–glutathione cycle in oilseed rape roots. *Plant Growth Regulation*, *84*(1), 135-148.

Farooq, M. A., Zhang, K., Islam, F., Wang, J., Athar, H. U., Nawaz, A., Ullah Zafar, Z., Xu, J.& Zhou, W. (2018). Physiological and iTRAQ-Based Quantitative Proteomics Analysis of Methyl Jasmonate–Induced Tolerance in Brassica napus Under Arsenic Stress. *Proteomics, 18*(10), 1700290.

Fernández, Y. T., Diaz, O., Acuna, E., Casanova, M., Salazar, O., & Masaguer, A. (2016). Phytostabilization of arsenic in soils with plants of the genus Atriplex established in situ in the Atacama Desert. *Environmental Monitoring and Assessment*, *188*(4), 235.

Farnese, F. S., Oliveira, J. A., Paiva, E. A., Menezes-Silva, P. E., da Silva, A. A., Campos, F. V., & Ribeiro, C. (2017). The involvement of nitric oxide in integration of plant physiological and ultrastructural adjustments in response to arsenic. *Frontiers in Plant Science*, *8*, 516.

Favas, P. J., Pratas, J., Varun, M., D'Souza, R., & Paul, M. S. (2014). Phytoremediation of soils contaminated with metals and metalloids at mining areas: potential of native flora. *Environmental Risk Assessment of Soil Contamination*, *3*, 485-516.

Finnegan, P., & Chen, W. (2012). Arsenic toxicity: the effects on plant metabolism. *Frontiers in Physiology*, *3*, 182.

Firmino, A. A. P., Gorka, M., Graf, A., Skirycz, A., Martinez-Seidel, F., Zander, K., Kopka, J. & Beine-Golovchuk, O. (2020). Separation and Paired Proteome Profiling of Plant Chloroplast and Cytoplasmic Ribosomes. *Plants*, *9*(7), 892.

Flora, S. J. S. (2020). Preventive and therapeutic strategies for acute and chronic human arsenic exposure. In *Arsenic in drinking water and food* (pp. 341-370). Springer, Singapore.

Foyer, C. H. (2018). Reactive oxygen species, oxidative signaling and the regulation of photosynthesis. *Environmental and Experimental Botany*, *154*, 134-142.

Francesconi, K. A., & Kuehnelt, D. (2004). Determination of arsenic species: a critical review of methods and applications, 2000–2003. *Analyst*, *129*(5), 373-395.

Franchi, E., Rolli, E., Marasco, R., Agazzi, G., Borin, S., Cosmina, P., Pedron, F., Rosellini, I., Barbafieri, M. & Petruzzelli, G. (2017). Phytoremediation of a multi contaminated soil: mercury and arsenic phytoextraction assisted by mobilizing agent and plant growth promoting bacteria. *Journal of Soils and Sediments*, *17*(5), 1224-1236.

Fru, E. C., Callac, N., Posth, N. R., Argyraki, A., Ling, Y. C., Ivarsson, M., Broman, C. & Kilias, S. P. (2018). Arsenic and high affinity phosphate uptake gene distribution in shallow submarine hydrothermal sediments. *Biogeochemistry*, *141*(1), 41-62.

Fu, H. L., Meng, Y., Ordóñez, E., Villadangos, A. F., Bhattacharjee, H., Gil, J. A., Mateos, L.M & Rosen, B. P. (2009). Properties of arsenite efflux permeases (Acr3) from Alkaliphilus metalliredigens and Corynebacterium glutamicum. *Journal of Biological Chemistry*, *284*(30), 19887-19895.

Gadd, G. M. (2019). Arsenic toxicity: an arsenic-hyperaccumulating fern uses a bacterial-like tolerance mechanism. *Current Biology*, *29*(12), R580-R582.

Garg, N., & Kashyap, L. (2017). Silicon and Rhizophagus irregularis: potential candidates for ameliorating negative impacts of arsenate and arsenite stress on growth, nutrient acquisition and productivity in Cajanus cajan (L.) Millsp. genotypes. *Environmental Science and Pollution Research*, *24*(22), 18520-18535.

Geng, C. N., Zhu, Y. G., Hu, Y., Williams, P., & Meharg, A. A. (2006). Arsenate causes differential acute toxicity to two P-deprived genotypes of rice seedlings (Oryza sativa L.). *Plant and Soil*, *279*(1-2), 297-306.

Ghosal, D., Ghosh, S., Dutta, T. K., & Ahn, Y. (2016). Current state of knowledge in microbial degradation of polycyclic aromatic hydrocarbons (PAHs): a review. *Frontiers in Microbiology*, *7*, 1369.

Ghosal, P. S., Kattil, K. V., Yadav, M. K., & Gupta, A. K. (2018). Adsorptive removal of arsenic by novel iron/olivine composite: Insights into preparation and adsorption process by response surface methodology and artificial neural network. *Journal of Environmental Management*, *209*, 176-187.

Ghosh, P., Rathinasabapathi, B., & Ma, L. Q. (2011). Arsenic-resistant bacteria solubilized arsenic in the growth media and increased growth of arsenic hyperaccumulator Pteris vittata L. *Bioresource Technology*, *102*(19), 8756-8761.

Ghosh, P. K., Maiti, T. K., Pramanik, K., Ghosh, S. K., Mitra, S., & De, T. K. (2018). The role of arsenic resistant Bacillus aryabhattai MCC3374 in promotion of rice seedlings growth and alleviation of arsenic phytotoxicity. *Chemosphere*, *211*, 407-419.

Gill, R. A., Zang, L., Ali, B., Farooq, M. A., Cui, P., Yang, S., Ali, S. & Zhou, W. (2015). Chromium-induced physio-chemical and ultrastructural changes in four cultivars of Brassica napus L. *Chemosphere, 120*, 154-164.

Gill, S. S., & Tuteja, N. (2010). Reactive oxygen species and antioxidant machinery in abiotic stress tolerance in crop plants. *Plant Physiology and Biochemistry, 48*(12), 909-930.

Gilhotra, V., Das, L., Sharma, A., Kang, T. S., Singh, P., Dhuria, R. S., & Bhatti, M. S. (2018). Electrocoagulation technology for high strength arsenic wastewater: process optimization and mechanistic study. *Journal of Cleaner Production*, *198*, 693-703.

Glick, B. R. (2012). Plant growth-promoting bacteria: mechanisms and applications. *Scientifica*, *2012*.

Glick, B. R. (2010). Using soil bacteria to facilitate phytoremediation. *Biotechnology Advances*, *28*(3), 367-374.

Gomes, J. A., Daida, P., Kesmez, M., Weir, M., Moreno, H., Parga, J. R., . . . Peterson, E. (2007). Arsenic removal by electrocoagulation using combined Al–Fe electrode system and characterization of products. *Journal of hazardous materials, 139*(2), 220-231.

González, H., Fernández-Fuego, D., Bertrand, A., & González, A. (2019). Effect of pH and citric acid on the growth, arsenic accumulation, and phytochelatin synthesis in Eupatorium cannabinum L., a promising plant for phytostabilization. *Environmental Science and Pollution Research*, *26*(25), 26242-26253.

Gouda, S., Kerry, R. G., Das, G., Paramithiotis, S., Shin, H. S., & Patra, J. K. (2018). Revitalization of plant growth promoting rhizobacteria for sustainable development in agriculture. *Microbiological Research*, *206*, 131-140.

Goudjal, Y., Toumatia, O., Sabaou, N., Barakate, M., Mathieu, F., & Zitouni, A. (2013). Endophytic actinomycetes from spontaneous plants of Algerian Sahara: indole-3-acetic acid production and tomato plants growth promoting activity. *World Journal of Microbiology and Biotechnology*, *29*(10), 1821-1829.

Guimarães, L. H. S., Segura, F. R., Tonani, L., von-Zeska-Kress, M. R., Rodrigues, J. L., Calixto, L. A., Silva, F.F. & Batista, B. L. (2019). Arsenic volatilization by Aspergillus sp. and Penicillium sp. isolated from rice rhizosphere as a promising eco-safe tool for arsenic mitigation. *Journal of Environmental Management*, *237*, 170-179.

Guarino, F., Miranda, A., Castiglione, S., & Cicatelli, A. (2020). Arsenic phytovolatilization and epigenetic modifications in Arundo donax L. assisted by a PGPR consortium. *Chemosphere, 251*, 126310.

Gul, I., Manzoor, M., Silvestre, J., Rizwan, M., Hina, K., Kallerhoff, J., & Arshad, M. (2019). EDTA-assisted phytoextraction of lead and cadmium by Pelargonium cultivars grown on spiked soil. *International Journal of Phytoremediation*, *21*(2), 101-110.

Guo, J., Tang, S., Ju, X., Ding, Y., Liao, S., & Song, N. (2011). Effects of inoculation of a plant growth promoting rhizobacterium Burkholderia sp. D54 on plant growth and metal uptake by a hyperaccumulator Sedum alfredii Hance grown on multiple metal contaminated soil. *World Journal of Microbiology and Biotechnology*, *27*(12), 2835-2844.

Gupta, P., Kumar, V., Usmani, Z., Rani, R., Chandra, A., & Gupta, V. K. (2020). Implications of plant growth promoting Klebsiella sp. CPSB4 and Enterobacter sp. CPSB49 in luxuriant growth of tomato plants under chromium stress. *Chemosphere, 240*, 124944.

Gupta, S., Mishra, S. K., Misra, S., Pandey, V., Agrawal, L., Nautiyal, C. S., & Chauhan, P. S. (2020). Revealing the complexity of protein abundance in chickpea root under drought-stress using a comparative proteomics approach. *Plant Physiology and Biochemistry*.

Gupta, S. K. (2014). Life cycle assessment of arsenic from poultry feed to agricultural crops. University of Alberta,

Hackstadt, A. J., & Hess, A. M. (2009). Filtering for increased power for microarray data analysis. *BMC Bioinformatics*, *10*(1), 11.

Han, Y. H., Liu, X., Rathinasabapathi, B., Li, H. B., Chen, Y., & Ma, L. Q. (2017). Mechanisms of efficient As solubilization in soils and As accumulation by As-hyperaccumulator Pteris vittata. *Environmental Pollution*, *227*, 569-577.

Hall, J. Á. (2002). Cellular mechanisms for heavy metal detoxification and tolerance. *Journal of Experimental Botany*, *53*(366), 1-11.

Hao, L., Wang, N., Wang, C., & Li, G. (2018). Arsenic removal from water and river water by the combined adsorption-UF membrane process. *Chemosphere, 202*, 768-776.

Harish, S., Kavino, M., Kumar, N., Balasubramanian, P., & Samiyappan, R. (2009). Induction of defense-related proteins by mixtures of plant growth promoting endophytic bacteria against Banana bunchy top virus. *Biological Control, 51*(1), 16-25.

Hasanuzzaman, M., Nahar, K., Hossain, M., Mahmud, J., Rahman, A., Inafuku, M., Oku, H. & Fujita, M. (2017). Coordinated actions of glyoxalase and antioxidant defense systems in conferring abiotic stress tolerance in plants. *International Journal of Molecular Sciences, 18*(1), 200.

He, J., He, C., Chen, X., Liang, X., Huang, T., Yang, X., & Shang, H. (2018). Comparative study of remediation of Cr (VI)-contaminated soil using electrokinetics combined with bioremediation. *Environmental Science and Pollution Research, 25*(18), 17682-17689.

He, Y., Xiang, Y., Zhou, Y., Yang, Y., Zhang, J., Huang, H., Shang, C., Luo, L., Gao, J. & Tang, L. (2018). Selenium contamination, consequences and remediation techniques in water and soils: a review. *Environmental Research, 164*, 288-301.

Health, U. D. o., & Services, H. (2000). *Toxicological profile for arsenic*.

Hering, J. G., Katsoyiannis, I. A., Theoduloz, G. A., Berg, M., & Hug, S. J. (2017). *Arsenic removal from drinking water: Experiences with technologies and constraints in practice* (Doctoral dissertation, American Society of Civil Engineers).

Hlihor, R. M., Gavrilescu, M., Tavares, T., Favier, L., & Olivieri, G. (2017). Bioremediation: an overview on current practices, advances, and new perspectives in environmental pollution treatment.

Hossain, M. M., Khatun, M. A., Haque, M. N., Bari, M. A., Alam, M. F., Mandal, A., & Kabir, A. H. (2018). Silicon alleviates arsenic-induced toxicity in wheat through vacuolar sequestration and ROS scavenging. *International Journal of Phytoremediation*, *20*(8), 796-804.

Hossain, M. A., Piyatida, P., da Silva, J. A. T., & Fujita, M. (2012). Molecular mechanism of heavy metal toxicity and tolerance in plants: central role of glutathione in detoxification of reactive oxygen species and methylglyoxal and in heavy metal chelation. *Journal of Botany, 2012*.

Hossain, Z., & Komatsu, S. (2013). Contribution of proteomic studies towards understanding plant heavy metal stress response. *Frontiers in Plant Science, 3,* 310.

Hou, J., *et al.* (2019). Joint Nanotoxicology Assessment Provides a New Strategy for Developing Nanoenabled Bioremediation Technologies: ACS Publications.

Hrynkiewicz, K., Złoch, M., Kowalkowski, T., Baum, C., & Buszewski, B. (2018). Efficiency of microbially assisted phytoremediation of heavy-metal contaminated soils. *Environmental Reviews*, *26*(3), 316-332.

Huang, W. L., Wu, F. L., Huang, H. Y., Huang, W. T., Deng, C. L., Yang, L. T., Huang, Z.R. & Chen, L. S. (2020). Excess Copper-Induced Alterations of Protein Profiles and Related Physiological Parameters in Citrus Leaves. *Plants*, *9*(3), 291.

Huang, Z. C., AN, Z. Z., Chen, T. B., Mei, L. E. I., Xiao, X. Y., & Liao, X. Y. (2007). Arsenic uptake and transport of Pteris vittata L. as influenced by phosphate and inorganic arsenic species under sand culture. *Journal of Environmental Sciences*, *19*(6), 714-718.

Huihui, Z., Xin, L., Yupeng, G., Mabo, L., Yue, W., Meijun, A., Guanjun, L., Nan, X. & Guangyu, S. (2020). Physiological and proteomic responses of reactive oxygen species metabolism and antioxidant machinery in mulberry (Morus alba L.) seedling leaves to NaCl and NaHCO3 stress. *Ecotoxicology and Environmental Safety*, *193*, 110259.

Hussain, A., Kamran, M. A., Javed, M. T., Hayat, K., Farooq, M. A., Ali, N., Ali, M., Manghwar, H., Jan, F. & Chaudhary, H. J. (2019). Individual and combinatorial application of Kocuria rhizophila and citric acid on phytoextraction of multi-metal contaminated soils by Glycine max L. *Environmental and Experimental Botany*, *159*, 23-33.

Irshad, S., Xie, Z., Wang, J., Nawaz, A., Luo, Y., Wang, Y., & Mehmood, S. (2020). Indigenous strain Bacillus XZM assisted phytoremediation and detoxification of arsenic in Vallisneria denseserrulata. *Journal of Hazardous Materials, 381*, 120903.

Isnaini, I., Yasmina, A., & Nur'amin, H. W. (2019). Antioxidant and cytotoxicity activities of Karamunting (Melastoma malabathricum L.L.) fruit ethanolic extract and quercetin. *Asian Pacific Journal of Cancer Prevention: APJCP*, *20*(2), 639.

Jadhav, S. V., Häyrynen, P., Marathe, K. V., Rathod, V. K., Keiski, R. L., & Yadav, G. D. (2017). Experimental and Modeling Assessment of Sulfate and Arsenic Removal from Mining Wastewater by Nanofiltration. *International Journal of Chemical Reactor Engineering, 16*(1).

Jain, C., & Ali, I. (2000). Arsenic: occurrence, toxicity and speciation techniques. *Water Research, 34*(17), 4304-4312.

Jesitha, K., and P. Harikumar. (2018). Application of Nano-Phytoremediation Technology for Soil Polluted with Pesticide Residues and Heavy Metals *Phytoremediation* (pp. 415-439): Springer.

Joshi, N., Wang, X., Montgomery, L., Elfick, A., & French, C. E. (2009). Novel approaches to biosensors for detection of arsenic in drinking water. *Desalination, 248*(1-3), 517-523.

Kamsani, N., Zakaria, Z., Md Nasir, N., Mohtarrudin, N., & Mohamad Alitheen, N. (2019). Safety Assessment of Methanol Extract of Melastoma malabathricum L.L. Leaves following the Subacute and Subchronic Oral Consumptions in Rats and Its Cytotoxic Effect against the HT29 Cancer Cell Line. *Evidence-Based Complementary and Alternative Medicine, 2019*.

Kanel, S. R., Manning, B., Charlet, L., & Choi, H. (2005). Removal of arsenic (III) from groundwater by nanoscale zero-valent iron. *Environmental Science & Technology*, *39*(5), 1291-1298.

Karakurt, S. (2019). Removal of Carcinogenic Arsenic from Drinking Water By the Application of Ion Exchange Resins. *Oncogen Journal, 2*(1), 5.

Kashyap, L., & Garg, N. (2018). Arsenic Toxicity in Crop Plants: Responses and Remediation Strategies. In *Mechanisms of Arsenic Toxicity and Tolerance in Plants* (pp. 129-169). Springer, Singapore.

Kato, M., Onuma, S., Kato, Y., Thang, N. D., Yajima, I., Hoque, M. Z., & Shekhar, H. U. (2010). Toxic elements in well water from Malaysia. *Toxicological & Environmental Chemistry, 92*(9), 1609-1612.

Katsoyiannis, I. A., Mitrakas, M., & Zouboulis, A. I. (2015). Arsenic occurrence in Europe: Emphasis in Greece and description of the applied full-scale treatment plants. *Desalination and Water Treatment*, *54*(8), 2100-2107.

Kaur, P., Singh, S., Kumar, V., Singh, N., & Singh, J. (2018). Effect of rhizobacteria on arsenic uptake by macrophyte Eichhornia crassipes (Mart.) Solms. *International Journal of Phytoremediation*, *20*(2), 114-120.

Ke, C., Zhao, C., Rensing, C., Yang, S., & Zhang, Y. (2018). Characterization of recombinant E. coli expressing arsR from Rhodopseudomonas palustris CGA009 that displays highly selective arsenic adsorption. *Applied Microbiology and Biotechnology*, *102*(14), 6247-6255.

Kechavarzi, C., Pettersson, K., Leeds-Harrison, P., Ritchie, L., & Ledin, S. (2007). Root establishment of perennial ryegrass (L. perenne) in diesel contaminated subsurface soil layers. *Environmental Pollution*, *145*(1), 68-74.

Keller, C. K., & Radwan, O. (2015). The functional role of 14-3-3 proteins in plant-stress interactions. *i-ACES*, *1*(2), 100-110.

Khan, D. H., Duckett, J. G., Frankland, B., & Kirkham, J. B. (1984). An X-ray microanalytical study of the distribution of cadmium in roots of Zea mays L. *Journal of Plant Physiology*, *115*(1), 19-28.

Khan, N. F., Rasool, A., Mansoor, S., Saleem, S., Baba, T. R., Haq, S. M., Rehman, S.A., Adetunji, C.O. & Popescu, S. M. (2022). Potential Applications of Rhizobacteria as Eco-Friendly Biological Control, Plant Growth Promotion and Soil Metal Bioremediation.

Khan, K. Y., Ali, B., Stoffella, P. J., Cui, X., Yang, X., & Guo, Y. (2020). Study amino acid contents, plant growth variables and cell ultrastructural changes induced by cadmium stress between two contrasting cadmium accumulating cultivars of Brassica rapa ssp. chinensis L.(pak choi). *Ecotoxicology and Environmental Safety*, *200*, 110748.

Khan, M., Nawaz, N., Ali, I., Azam, M., Rizwan, M., Ahmad, P., & Ali, S. (2019). Regulation of photosynthesis under metal stress. *Photosynthesis, Productivity and Environmental Stress*, 95-105.

Khan, M., Samrana, S., Zhang, Y., Malik, Z., Khan, M. D., & Zhu, S. (2020). Reduced Glutathione Protects Subcellular Compartments From Pb-Induced ROS Injury in Leaves and Roots of Upland Cotton (Gossypium hirsutum L.). *Frontiers in Plant Science*, *11*.

Khanna, K., Jamwal, V. L., Gandhi, S. G., Ohri, P., & Bhardwaj, R. (2019). Metal resistant PGPR lowered Cd uptake and expression of metal transporter genes with improved growth and photosynthetic pigments in Lycopersicon esculentum under metal toxicity. *Scientific Reports*, *9*(1), 1-14.

Khatri, S., Sharma, R. K., & Shridhar, V. (2020). Influence of Cadmium-Tolerant and Plant Growth-Promoting Rhizobacteria on Cadmium Accumulation and

Growth Response of Wheat Seedlings Under Mountain Ecosystem. *Agricultural Research*, *9*(1), 56-65.

Kleinknecht, L., Wang, F., Stübe, R., Philippar, K., Nickelsen, J., & Bohne, A. V. (2014). RAP, the sole octotricopeptide repeat protein in Arabidopsis, is required for chloroplast 16S rRNA maturation. *The Plant Cell*, *26*(2), 777-787.

Kim, E. J., & Baek, K. (2019). Selective recovery of ferrous oxalate and removal of arsenic and other metals from soil-washing wastewater using a reduction reaction. *Journal of Cleaner Production*, *221*, 635-643.

Kim, I. S., Kang, K. H., Johnson-Green, P., & Lee, E. J. (2003). Investigation of heavy metal accumulation in Polygonum thunbergii for phytoextraction. *Environmental Pollution*, *126*(2), 235-243.

Koay, S. (2008). Establishment of cell suspension culture of Melastoma malabathricum L.L. for the production of anthocyanin. *Disertasi). Malaysia: Universiti Sains Malaysia*.

Kong, Z., and B. R. Glick. (2017). The Role of Plant Growth-Promoting Bacteria in Metal Phytoremediation. *Advances in Microbial Physiology* (Vol. 71, pp. 97-132): Elsevier.

Korres, N. E. (2019). Herbicide Effects on Humans: Exposure, Short and Long-term Effects and Occupational Hygiene. *WEED CONTROL*, 14.

Kosová, K., Vítámvás, P., Prášil, I. T., & Renaut, J. (2011). Plant proteome changes under abiotic stress—contribution of proteomics studies to understanding plant stress response. *Journal of Proteomics, 74*(8), 1301-1322.

Kuffner, M., De Maria, S., Puschenreiter, M., Fallmann, K., Wieshammer, G., Gorfer, M., Strauss, J., Rivelli, A.R. & Sessitsch, A. (2010). Culturable bacteria from Zn-and Cd-accumulating Salix caprea with differential effects on plant growth and heavy metal availability. *Journal of Applied Microbiology*, *108*(4), 1471-1484.

Kumar, M., RaoT, S., Isloor, A. M., Ibrahim, G. S., Ismail, N., Ismail, A. F., & Asiri, A. M. (2019). Use of cellulose acetate/polyphenylsulfone derivatives to fabricate ultrafiltration hollow fiber membranes for the removal of arsenic from drinking water. *International Journal of Biological Macromolecules, 129*, 715-727.

Kumar, P. R., Chaudhari, S., Khilar, K. C., & Mahajan, S. (2004). Removal of arsenic from water by electrocoagulation. *Chemosphere*, *55*(9), 1245-1252.

Kumar, S., Dubey, R. S., Tripathi, R. D., Chakrabarty, D., & Trivedi, P. K. (2015). Omics and biotechnology of arsenic stress and detoxification in plants: current updates and prospective. *Environment International*, *74*, 221-230.

Kushwaha, B. K., Singh, S., Tripathi, D. K., Sharma, S., Prasad, S. M., Chauhan, D. K., Kumar, V. & Singh, V. P. (2019). New adventitious root formation and primary root biomass accumulation are regulated by nitric oxide and reactive oxygen species in rice seedlings under arsenate stress. *Journal of Hazardous Materials*, *361*, 134-140.

Leão, G. A., Oliveira, J. A. D., Felipe, R. T. A., & Farnese, F. S. (2017). Phytoremediation of arsenic-contaminated water: the role of antioxidant metabolism of Azolla caroliniana Willd.(Salviniales). *Acta Botanica Brasilica*, *31*(2), 161-168.

Le Lay, P., Isaure, M.-P., Sarry, J.-E., Kuhn, L., Fayard, B., Le Bail, J.-L., Bastien, O., Garin, J., Roby, C.& Bourguignon, J. (2006). Metabolomic, proteomic and biophysical analyses of Arabidopsis thaliana cells exposed to a caesium stress. Influence of potassium supply. *Biochimie*, *88*(11), 1533-1547.

Learman, D. R., Ahmad, Z., Brookshier, A., Henson, M. W., Hewitt, V., Lis, A., Morrison, C., Robinson, A., Todaro, E., Wologo, E. & Wologo, E. (2019). Comparative genomics of 16 Microbacterium spp. that tolerate multiple heavy metals and antibiotics. *Peer Journal, 6*, e6258.

Li, C., Hou, H., Yang, J., Liang, S., Shi, Y., Guan, R., Hu, Y., Wu, X., Hu, J.&Wang, L. (2019). Comparison of electrokinetic remediation on lead-contaminated kaolinite and natural soils. *CLEAN–Soil, Air, Water, 47*(4), 1800337.

Li, T., Yang, X., Lu, L., Islam, E., & He, Z. (2009). Effects of zinc and cadmium interactions on root morphology and metal translocation in a hyperaccumulating species under hydroponic conditions. *Journal of Hazardous Materials, 169*(1-3), 734-741.

Li, W. C., Ye, Z. H., & Wong, M. H. (2007). Effects of bacteria on enhanced metal uptake of the Cd/Zn-hyperaccumulating plant, Sedum alfredii. *Journal of Experimental Botany*, *58*(15-16), 4173-4182.

Li, Y., Liu, X., Hao, T., & Chen, S. (2017). Colonization and maize growth promotion induced by phosphate solubilizing bacterial isolates. *International Journal of Molecular Sciences, 18*(7), 1253.

Li, Y. F., Wang, D., Li, B., Dong, L., & Sun, G. (2019). Development of Arsenic Removal Technology from Drinking Water in Developing Countries. In *Arsenic Contamination in Asia* (pp. 163-179): Springer.

Lin, Y., Fan, J., Yu, J., Jiang, S., Yan, C., & Liu, J. (2018). Root activities and arsenic translocation of Avicennia marina (Forsk.) Vierh seedlings influenced by sulfur and iron amendments. *Marine Pollution Bulletin, 135*, 1174-1182.

Lindsay, E. R., & Maathuis, F. J. (2017). New molecular mechanisms to reduce arsenic in crops. *Trends in Plant Science*, *22*(12), 1016-1026.

Liu, L., Bilal, M., Duan, X., & Iqbal, H. M. (2019). Mitigation of environmental pollution by genetically engineered bacteria—Current challenges and future perspectives. *Science of The Total Environment*, *667*, 444-454.

Liu, P., Huang, R., Hu, X., Jia, Y., Li, J., Luo, J., Liu, Q., Luo, L., Liu, G & Chen, Z. (2019). Physiological responses and proteomic changes reveal insights into Stylosanthes response to manganese toxicity. *BMC Plant Biology*, *19*(1), 212.

Liu, L., Li, W., Song, W., & Guo, M. (2018). Remediation techniques for heavy metal-contaminated soils: principles and applicability. *Science of the Total Environment, 633*, 206-219.

Liu, Q., Leslie, E. M., Moe, B., Zhang, H., Douglas, D. N., Kneteman, N. M., & Le, X. C. (2018). Metabolism of a phenylarsenical in human hepatic cells and identification of a new arsenic metabolite. *Environmental Science & Technology, 52*(3), 1386-1392.

Liu, X., Feng, H. Y., Fu, J. W., Sun, D., Cao, Y., Chen, Y., Xiang, P., Liu, Y. & Ma, L. Q. (2018). Phytate promoted arsenic uptake and growth in arsenic-hyperaccumulator Pteris vittata by upregulating phosphorus transporters. *Environmental Pollution, 241*, 240-246.

Liu, Z. F., Ge, H. G., Li, C., Zhao, Z. P., Song, F. M., & Hu, S. B. (2015). Enhanced phytoextraction of heavy metals from contaminated soil by plant co-cropping associated with PGPR. *Water, Air, & Soil Pollution*, *226*(3), 29.

Lone, M. I., He, Z. L., Stoffella, P. J., & Yang, X. E. (2008). Phytoremediation of heavy metal polluted soils and water: progresses and perspectives. *Journal of Zhejiang University Science B*, *9*(3), 210-220.

Long, R., Li, M., Zhang, T., Kang, J., Sun, Y., & Yang, Q. (2019). Comparative proteomic analysis reveals differential root proteins in Medicago sativa and Medicago truncatula in response to salt stress. *The Model Legume Medicago truncatula*, 1102-1111.

Lourenço, J., Mendo, S., & Pereira, R. (2019). Rehabilitation of Radioactively Contaminated Soil: Use of Bioremediation/Phytoremediation Techniques. In *Remediation Measures for Radioactively Contaminated Areas* (pp. 163-200). Springer, Cham.

Lozecznik, S. (2018). Facultative Endophytic Plant Growth Promoting Bacteria: Google Patents.

Lozecznik, S. (2020). *U.S. Patent No. 10,752,877*. Washington, DC: U.S. Patent and Trademark Office.

Luo, S. L., Chen, L., Chen, J. L., Xiao, X., Xu, T. Y., Wan, Y., Rao, C., Liu, C.B., Liu, Y.T., Lai, C. & Zeng, G. M. (2011). Analysis and characterization of cultivable heavy metal-resistant bacterial endophytes isolated from Cd-hyperaccumulator Solanum nigrum L. and their potential use for phytoremediation. *Chemosphere*, *85*(7), 1130-1138.

Luzarowski, M., Kosmacz, M., Sokolowska, E., Jasińska, W., Willmitzer, L., Veyel, D., & Skirycz, A. (2017). Affinity purification with metabolomic and proteomic analysis unravels diverse roles of nucleoside diphosphate kinases. *Journal of Experimental Botany, 68*(13), 3487-3499.

Lv, X., Li, Y., Xiao, Q., & Li, D. (2019). Daphnetin activates the Nrf2-dependent antioxidant response to prevent arsenic-induced oxidative insult in human lung epithelial cells. *Chemico-Biological Interactions, 302*, 93-100.

Ma, J., Sheng, H., Li, X., & Wang, L. (2016). iTRAQ-based proteomic analysis reveals the mechanisms of silicon-mediated cadmium tolerance in rice (Oryza sativa) cells. *Plant Physiology and Biochemistry, 104*, 71-80.

Ma, L. Q., Komar, K. M., Tu, C., Zhang, W., Cai, Y., & Kennelley, E. D. (2001). A fern that hyperaccumulates arsenic. *Nature*, *409*(6820), 579-579.

Ma, Y., Rajkumar, M., Vicente, J. A. F., & Freitas, H. (2010). Inoculation of Ni-resistant plant growth promoting bacterium Psychrobacter sp. strain SRS8 for the improvement of nickel phytoextraction by energy crops. *International Journal of Phytoremediation*, *13*(2), 126-139.

Ma, Y., Rajkumar, M., Zhang, C., & Freitas, H. (2016). Beneficial role of bacterial endophytes in heavy metal phytoremediation. *Journal of Environmental Management*, *174*, 14-25.

Mahmood-ul-Hassan, M., Yousra, M., Saman, L., & Ahmad, R. (2020). Floriculture: alternate non-edible plants for phyto-remediation of heavy metal contaminated soils. *International Journal of Phytoremediation*, *22*(7), 725-732.

Mahmud, K., & Burslem, D. F. (2020). Contrasting growth responses to Aluminium addition among populations of the Aluminum accumulator Melastoma malabathricum L.L. *AoB PLANTS*.

Maitlo, H. A., Kim, J. H., Kim, K.-H., Park, J. Y., & Khan, A. (2018). Metal-air fuel cell electrocoagulation techniques for the treatment of arsenic in water. *Journal of Cleaner Production*.

Majid, F. A. A. Basic in vitro studies of human skin culture: Melastoma malabathricum L.extract on fibroblasts growth (kajian dasar kultur kulit manusia secara in vitro: ektrak Melastoma malabathricum L.ke atas pertumbuhan fibroblasts).

Mailloux, B. J., Alexandrova, E., Keimowitz, A. R., Wovkulich, K., Freyer, G. A., Herron, M., Stolz, J.F., Kenna, T.C., Pichler, T., Polizzotto, M.L. & Dong, H. (2009). Microbial mineral weathering for nutrient acquisition releases arsenic. *Applied and Environmental Microbiology*, *75*(8), 2558-2565.

Malik, D. K., & Sindhu, S. S. (2011). Production of indole acetic acid by Pseudomonas sp.: effect of coinoculation with Mesorhizobium sp. Cicer on nodulation and plant growth of chickpea (Cicer arietinum). *Physiology and Molecular Biology of Plants*, *17*(1), 25-32.

Mallick, I., Bhattacharyya, C., Mukherji, S., Dey, D., Sarkar, S. C., Mukhopadhyay, U. K., & Ghosh, A. (2018). Effective rhizoinoculation and biofilm formation by arsenic immobilizing halophilic plant growth promoting bacteria (PGPB) isolated from mangrove rhizosphere: a step towards arsenic rhizoremediation. *Science of The Total Environment, 610*, 1239-1250.

Mandal, B. K., & Suzuki, K. T. (2002). Arsenic round the world: a review. *Talanta*, *58*(1), 201-235.

Marinho, B. A., Cristóvão, R. O., Boaventura, R. A., & Vilar, V. J. (2019). As (III) and Cr (VI) oxyanion removal from water by advanced oxidation/reduction processes—a review. *Environmental Science and Pollution Research*, *26*(3), 2203-2227.

Marques, A. P., Pires, C., Moreira, H., Rangel, A. O., & Castro, P. M. (2010). Assessment of the plant growth promotion abilities of six bacterial isolates using Zea mays as indicator plant. *Soil Biology and Biochemistry, 42*(8), 1229-1235.

Martins, F. R., Rüther, R., Pereira, E. B., & Abreu, S. L. (2008). Solar energy scenarios in Brazil. Part two: Photovoltaics applications. *Energy Policy*, *36*(8), 2865-2877.

Martin, B. C., George, S. J., Price, C. A., Ryan, M. H., & Tibbett, M. (2014). The role of root exuded low molecular weight organic anions in facilitating petroleum hydrocarbon degradation: current knowledge and future directions. *Science of the Total Environment*, *472*, 642-653.

Masuda, T., Ishii, K., Morishita, Y., Iwasaki, N., Shibata, Y., & Tamaoka, A. (2018). Hepatic histopathological changes and dysfunction in primates following exposure to organic arsenic diphenylarsinic acid. *The Journal of Toxicological Sciences, 43*(5), 291-298.

Mat, M. S. C., Diah, J. M., Din, M. A. M., & Samad, A. M. (2014, August). Data acquisition and representation of leaves using digital close range photogrammetry for species identification. In *2014 IEEE 5th Control and System Graduate Research Colloquium* (pp. 108-113). IEEE.

Meharg, A. A. (2003). Variation in arsenic accumulation–hyperaccumulation in ferns and their allies: rapid report. *New Phytologist*, *157*(1), 25-31.

Meharg, A. A., & Hartley-Whitaker, J. (2002). Arsenic uptake and metabolism in arsenic resistant and nonresistant plant species. *New Phytologist, 154*(1), 29-43.

Mehnaz, S., Kowalik, T., Reynolds, B., & Lazarovits, G. (2010). Growth promoting effects of corn (Zea mays) bacterial isolates under greenhouse and field conditions. *Soil Biology and Biochemistry, 42*(10), 1848-1856.

Mendoza-Hernández, J. C., Vázquez-Delgado, O. R., Castillo-Morales, M., Varela-Caselis, J. L., Santamaría-Juárez, J. D., Olivares-Xometl, O., Morales, J.A. Pérez-Osorio, G. (2019). Phytoremediation of mine tailings by Brassica juncea inoculated with plant growth-promoting bacteria. *Microbiological Research*.

Michalke, K., Wickenheiser, E. B., Mehring, M., Hirner, A. V., & Hensel, R. (2000). Production of volatile derivatives of metal (loid) s by microflora involved in anaerobic digestion of sewage sludge. *Applied and Environmental Microbiology*, *66*(7), 2791-2796.

Mishra, P., & Mishra, M. (2018). Risk assessment of heavy metal contamination in paddy soil, plants, and grains (Oryza sativa L.). In *Environmental Pollution of Paddy Soils* (pp. 165-178). Springer, Cham.

Mittal, S., & Johri, B. N. (2007). Assessment of rhizobacterial diversity of Triticum aestivum and Eleusine coracana from Northern region of India. *Current Science*, 1530-1537.

Mobar, S. (2018). Molecular and Biochemical analysis of Arsenite oxidation in bacteria isolated from Arsenic contaminated soil.

Mohora, E., Rončević, S., Agbaba, J., Zrnić, K., Tubić, A., & Dalmacija, B. (2018). Arsenic removal from groundwater by horizontal-flow continuous electrocoagulation (EC) as a standalone process. *Journal of Environmental Chemical Engineering, 6*(1), 512-519.

Møller, I. M. (2001). Plant mitochondria and oxidative stress: electron transport, NADPH turnover, and metabolism of reactive oxygen species. *Annual Review of Plant Biology*, *52*(1), 561-591.

Moussi, C. J. (2020). Transforming growth factor-beta targets Formin-like 2 for Angiopoietin-like 4 secretion during the epithelial mesenchymal transition (Doctoral dissertation, Philipps-Universität Marburg).

Mukherjee, G., Saha, C., Naskar, N., Mukherjee, A., Mukherjee, A., Lahiri, S., Majumder, A.L. & Seal, A. (2018). An Endophytic Bacterial Consortium modulates multiple strategies to improve Arsenic Phytoremediation Efficacy in Solanum nigrum. *Scientific Reports*, *8*(1), 6979.

Mukhopadhyay, R., & Rosen, B. P. (2002). Arsenate reductases in prokaryotes and eukaryotes. *Environmental Health Perspectives*, *110*(suppl 5), 745-748.

Mukhopadhyay, R., and B. P. Rosen. 1998. "Saccharomyces Cerevisiae Acr2 Gene Encodes an Arsenate Reductase." *FEMS Microbiology Letters*, 168(1): 127-136.

Muhamedagić, F., & Cero, M. (2020, June). Application of Eco-Compatibile Technology–Phytoremediation–Case Study with Phytoaccumulator Plantago lanceolata. In *International Conference "New Technologies, Development and Applications"* (pp. 770-778). Springer, Cham.

Mullineaux, P., & Karpinski, S. (2002). Signal transduction in response to excess light: getting out of the chloroplast. *Current Opinion in Plant Biology*, *5*(1), 43-48.

Najib, N., & Christodoulatos, C. (2019). Removal of arsenic using functionalized cellulose nanofibrils from aqueous solutions. *Journal of Hazardous Materials*, *367*, 256-266.

Nath, B., Chaudhuri, P., & Birch, G. (2014). Assessment of biotic response to heavy metal contamination in Avicennia marina mangrove ecosystems in Sydney Estuary, Australia. *Ecotoxicology and Environmental Safety*, *107*, 284-290.

Navazas, A., Hendrix, S., Cuypers, A., & González, A. (2019). Integrative response of arsenic uptake, speciation and detoxification by Salix atrocinerea. *Science of the Total Environment*, *689*, 422-433.

Nayak, A. K., Panda, S. S., Basu, A., & Dhal, N. K. (2018). Enhancement of toxic Cr (VI), Fe, and other heavy metals phytoremediation by the synergistic combination of native Bacillus cereus strain and Vetiveria zizanioides L. *International Journal of Phytoremediation*, *20*(7), 682-691.

Neilands, J. B. (1981). Microbial iron compounds. *Annual Review of Biochemistry*, *50*(1), 715-731.

Ng, J. C., Wang, J., & Shraim, A. (2003). A global health problem caused by arsenic from natural sources. *Chemosphere*, *52*(9), 1353-1359.

Nie, L., Shah, S., Rashid, A., Burd, G. I., Dixon, D. G., & Glick, B. R. (2002). Phytoremediation of arsenate contaminated soil by transgenic canola and the plant growth-promoting bacterium Enterobacter cloacae CAL2. *Plant Physiology and Biochemistry*, *40*(4), 355-361.

Nigussie, A., & Awgchew, H. (2022). Phytoremediation of Heavy Metal-Contaminated Soils: An Overview of Principles and Expectations for Fundamental Techniques. *American Journal of Environmental Science and Engineering*, *6*(2), 80-90.

Nunes-Nesi, A., Carrari, F., Lytovchenko, A., Smith, A. M., Loureiro, M. E., Ratcliffe, R. G., Sweetlove, L.J.& Fernie, A. R. (2005). Enhanced photosynthetic performance and growth as a consequence of decreasing mitochondrial malate dehydrogenase activity in transgenic tomato plants. *Plant Physiology*, *137*(2), 611-622.

Nwadinigwe, A. O., and E. C. Ugwu. (2018). Overview of Nano-Phytoremediation Applications *Phytoremediation* (pp. 377-382): Springer.

Oh, S. J., Son, J. H., Yoo, O., & Lee, D. H. (2007). Terahertz characteristics of electrolytes in aqueous Luria-Bertani media. *Journal of Applied Physics*, *102*(7), 074702.

Ojuederie, O. B., & Babalola, O. O. (2017). Microbial and plant-assisted bioremediation of heavy metal polluted environments: a review. *International Journal of Environmental Research and Public Health*, *14*(12), 1504.

Oliveira, B. R. M., de Almeida, A. A. F., Pirovani, C. P., Barroso, J. P., Neto, C. H. D. C., Santos, N. A., Ahnert, D., Baligar, V.C. & Mangabeira, P. A. O. (2020). Mitigation of Cd toxicity by Mn in young plants of cacao, evaluated by the proteomic profiles of leaves and roots. *Ecotoxicology*, 1-19.

Omar, C., Nurhadis, S., Ong Abdullah, J., Khairoji, K. A., Chin Chin, S., & Hamid, M. (2013). Effects of flower and fruit extracts of Melastoma malabathricum L.Linn. on growth of pathogenic bacteria: Listeria monocytogenes, Staphylococcus aureus, Escherichia coli, and Salmonella typhimurium. *Evidence-Based Complementary and Alternative Medicine, 2013*.

Ortega, A., Oliva, I., Contreras, K. E., González, I., Cruz-Díaz, M. R., & Rivero, E. P. (2017). Arsenic removal from water by hybrid electro-regenerated anion exchange resin/electrodialysis process. *Separation and Purification Technology, 184*, 319-326.

Osaki, M., Watanabe, T., & Tadano, T. (1997). Beneficial effect of aluminum on growth of plants adapted to low pH soils. *Soil Science and Plant Nutrition*, *43*(3), 551-563.

Páez-Espino, D., Tamames, J., de Lorenzo, V., & Cánovas, D. (2009). Microbial responses to environmental arsenic. *Biometals*, *22*(1), 117-130.

Páez-Espino, A. D., Durante-Rodríguez, G., & de Lorenzo, V. (2015). Functional coexistence of twin arsenic resistance systems in P seudomonas putida KT 2440. *Environmental Microbiology*, *17*(1), 229-238.

Pal, M., Chakrabortty, S., Nayak, J., & Pal, P. (2019). Removing toxic contaminants from groundwater by graphene oxide nanocomposite in a membrane module under response surface optimization. *International Journal of Environmental Science and Technology, 16*(8), 4583-4594.

Pal, P., Chakraborty, S., & Roy, M. (2012). Arsenic separation by a membrane-integrated hybrid treatment system: modeling, simulation, and techno-economic evaluation. *Separation Science and Technology, 47*(8), 1091-1101.

Pandey, N., & Bhatt, R. (2016). Role of soil associated Exiguobacterium in reducing arsenic toxicity and promoting plant growth in Vigna radiata. *European Journal of Soil Biology*, *75*, 142-150.

Pardo, T., Bernal, M. P., & Clemente, R. (2017). Phytostabilisation of severely contaminated mine tailings using halophytes and field addition of organic and inorganic amendments. *Chemosphere*, *178*, 556-564.

Patek-Mohd, N. N., Abdu, A., Jusop, S., Abdul-Hamid, H., Karim, M., Nazrin, M., Akbar, M.H. & Jamaluddin, A. S. (2018). Potentiality of Melastoma malabathricum L.as Phytoremediators of soil contaminated with sewage sludge. *Scientia Agricola*, *75*(1), 27-35.

Paulpriya, K. (2019). Phytochemical and Bioactive Potential of *Melastoma* malabathricum: an important medicinal herb. *Ethnomedicinal Plants with Therapeutic Properties*, 149.

Periathamby, A., Hamid, F. S., & Khidzir, K. (2009). Evolution of solid waste management in Malaysia: impacts and implications of the solid waste bill, 2007. *Journal of Material Cycles and Waste Management, 11*(2), 96-103.

Perez-Riverol, Y., Csordas, A., Bai, J., Bernal-Llinares, M., Hewapathirana, S., Kundu, D. J., Inuganti, A., Griss, J., Mayer, G., Eisenacher, M. & Pérez, E. (2019). The PRIDE database and related tools and resources in 2019: improving support for quantification data. *Nucleic Acids Research*, *47*(D1), D442-D450.

Pickering, I. J., Prince, R. C., George, M. J., Smith, R. D., George, G. N., & Salt, D. E. (2000). Reduction and coordination of arsenic in Indian mustard. *Plant Physiology*, *122*(4), 1171-1178.

Pinter, I. F., Salomon, M. V., Berli, F., Bottini, R., & Piccoli, P. (2017). Characterization of the As (III) tolerance conferred by plant growth promoting rhizobacteria to in vitro-grown grapevine. *Applied Soil Ecology*, *109*, 60-68.

Polya, D. A., & Middleton, D. R. (2017). Arsenic in drinking water: sources & human exposure. *Best Practice Guide on the Control of Arsenic in Drinking Water*, 1.

Prasad, K. S., Ramanathan, A. L., Paul, J., Subramanian, V., & Prasad, R. (2013). Biosorption of arsenite (As+ 3) and arsenate (As+ 5) from aqueous solution by Arthrobacter sp. biomass. *Environmental Technology*, *34*(19), 2701-2708.

Qi, J., Zhao, X., & Li, Z. (2020). iTRAQ-Based Quantitative Proteomic Analysis of the Arabidopsis Mutant opr3-1 in Response to Exogenous MeJA. *International Journal of Molecular Sciences*, *21*(2), 571.

Rabello, A. R., Guimarães, C. M., Rangel, P. H., da Silva, F. R., Seixas, D., de Souza, E., Brasileiro, A.C., Spehar, C.R., Ferreira, M.E. & Mehta, Â. (2008). Identification of drought-responsive genes in roots of upland rice (Oryza sativa L). *BMC Genomics*, *9*(1), 485.

Rady, M., & Romeh, A. (2019). Remediation of soil polluted with thiamethoxam using green nano–phytotechnology. *Journal of Productivity and Development*, *24*(3), 595-610.

Rafiq, M., Shahid, M., Abbas, G., Shamshad, S., Khalid, S., Niazi, N. K., & Dumat, C. (2017). Comparative effect of calcium and EDTA on arsenic uptake and physiological attributes of Pisum sativum. *International Journal of Phytoremediation*, *19*(7), 662-669.

Rahman, K. Z. (2009). Treatment of arsenic containing artificial wastewater in different laboratory-scale constructed wetlands. Oldenbourg Industrieverl.

Rajenderan, M. T. (2010). Ethno medicinal uses and antimicrobial properties of Melastoma malabathricum. *SEGi Review, 3*(2), 34-44.

Rajkumar, M., Sandhya, S., Prasad, M. N. V., & Freitas, H. (2012). Perspectives of plant-associated microbes in heavy metal phytoremediation. *Biotechnology Advances, 30*(6), 1562-1574.

Rajoo, K., Abdu, A., Singh, D., Abdul-Hamid, H., Jusop, S., & Zhen, W. (2013). Heavy metal uptake and translocation by Dipterocarpus verrucosus from sewage sludge contaminated soil. *American Journal of Environmental Science, 9*(3), 259-268.

Rajoo, K., Ismail, A., Karam, D., Omar, H., Muharam, F., & Zulperi, D. (2017). Phytoremediation Studies on Arsenic Contaminated Soils in Malaysia. *Journal of Advanced Chemical Sciences*, 490-493.

Rascio, N., & Navari-Izzo, F. (2011). Heavy metal hyperaccumulating plants: how and why do they do it? And what makes them so interesting?. *Plant Science*, *180*(2), 169-181.

Requejo, R., & Tena, M. (2005). Proteome analysis of maize roots reveals that oxidative stress is a main contributing factor to plant arsenic toxicity. *Phytochemistry, 66*(13), 1519-1528.

Requejo, R., & Tena, M. (2006). Maize response to acute arsenic toxicity as revealed by proteome analysis of plant shoots. *Proteomics*, *6*(S1), S156-S162.

Reeves, R. D., van der Ent, A., & Baker, A. J. (2018). Global distribution and ecology of hyperaccumulator plants. In *Agromining: Farming for Metals* (pp. 75-92). Springer, Cham.

Rehman, K., Imran, A., Amin, I., & Afzal, M. (2019). Enhancement of oil field-produced wastewater remediation by bacterially-augmented floating treatment wetlands. *Chemosphere*, *217*, 576-583.

Ren, X., Guo, S., Tian, W., Chen, Y., Han, H., Chen, E., Li, B., Li, Y. & Chen, Z. (2019). Effects of plant growth-promoting bacteria (PGPB) inoculation on the growth, antioxidant activity, Cu uptake, and bacterial community structure of rape (Brassica napus L.) grown in Cu-contaminated agricultural soil. *Frontiers in Microbiology*, *10*, 1455.

Retamal-Morales, G., Mehnert, M., Schwabe, R., Tischler, D., Zapata, C., Chávez, R., ... & Levicán, G. (2018). Detection of arsenic-binding siderophores in arsenic-tolerating Actinobacteria by a modified CAS assay. *Ecotoxicology and Environmental Safety, 157*, 176-181.

Rivero, E., Ortega, A., Cruz-Díaz, M., & González, I. (2018). Modelling the transport of ions and electrochemical regeneration of the resin in a hybrid ion exchange/electrodialysis process for As (V) removal. *Journal of Applied Electrochemistry, 48*(6), 597-610.

Ronzan, M., Zanella, L., Fattorini, L., Della Rovere, F., Urgast, D., Cantamessa, S., . . . Berta, G. (2017). The morphogenic responses and phytochelatin complexes induced by arsenic in Pteris vittata change in the presence of cadmium. *Environmental and Experimental Botany, 133*, 176-187.

Roy, M., Giri, A. K., Dutta, S., & Mukherjee, P. (2015). Integrated phytobial remediation for sustainable management of arsenic in soil and water. *Environment International*, *75*, 180-198.

Ryu, C. M., Farag, M. A., Hu, C. H., Reddy, M. S., Wei, H. X., Paré, P. W., & Kloepper, J. W. (2003). Bacterial volatiles promote growth in Arabidopsis. *Proceedings of the National Academy of Sciences*, *100*(8), 4927-4932.

Sabir, S., Akash, M. S. H., Fiayyaz, F., Saleem, U., Mehmood, M. H., & Rehman, K. (2019). Role of cadmium and arsenic as endocrine disruptors in the metabolism of carbohydrates: Inserting the association into perspectives. *Biomedicine & Pharmacotherapy, 114*, 108802.

Sakai, N., Alsaad, Z., Thuong, N. T., Shiota, K., Yoneda, M., & Mohd, M. A. (2017). Source profiling of arsenic and heavy metals in the Selangor River basin and their maternal and cord blood levels in Selangor State, Malaysia. *Chemosphere*, *184*, 857-865.

Saleem, M., Asghar, H. N., Zahir, Z. A., & Shahid, M. (2018). Impact of lead tolerant plant growth promoting rhizobacteria on growth, physiology, antioxidant activities, yield and lead content in sunflower in lead contaminated soil. *Chemosphere, 195*, 606-614.

Saleem, M., Law, A. D., Sahib, M. R., Pervaiz, Z. H., & Zhang, Q. (2018). Impact of root system architecture on rhizosphere and root microbiome. *Rhizosphere*, *6*, 47-51.

Samrana, S., Ali, A., Muhammad, U., Azizullah, A., Ali, H., Khan, M., Naz, S., Khan, M.D., Zhu, S.& Chen, J. (2020). Physiological, ultrastructural, biochemical, and molecular responses of glandless cotton to hexavalent chromium (Cr6+) exposure. *Environmental Pollution*, 115394.

Santoyo, G., Moreno-Hagelsieb, G., del Carmen Orozco-Mosqueda, M., & Glick, B. R. (2016). Plant growth-promoting bacterial endophytes. *Microbiological Research*, *183*, 92-99.

Sarath, N. G., Shackira, A. M., El-Serehy, H. A., Hefft, D. I., & Puthur, J. T. (2022). Phytostabilization of arsenic and associated physio-anatomical changes in Acanthus ilicifolius L. *Environmental Pollution*, 118828.

Sarkar, A., & Paul, B. (2016). The global menace of arsenic and its conventional remediation-A critical review. *Chemosphere, 158,* 37-49.

Sarry, J. E., Kuhn, L., Ducruix, C., Lafaye, A., Junot, C., Hugouvieux, V., . . . Vailhen, D. (2006). The early responses of Arabidopsis thaliana cells to cadmium exposure explored by protein and metabolite profiling analyses. *Proteomics, 6*(7), 2180-2198.

Satyapal, G. K., Rani, S., Kumar, M., & Kumar, N. (2016). Potential role of arsenic resistant bacteria in bioremediation: current status and future prospects. *Journal of Microbial Biochemical Technology, 8*(3), 256-258.

Sekhar, K. C., Kamala, C., Chary, N., & Mukherjee, A. (2007). Arsenic accumulation by Talinum cuneifolium–application for phytoremediation of arsenic-contaminated soils of Patancheru, Hyderabad, India. *Trace Metals and other Contaminants in the Environment, 9,* 315-337.

Selamat, S. N., Abdullah, S. R. S., & Idris, M. (2014). Phytoremediation of lead (Pb) and arsenic (As) by Melastoma malabathricum L.L. from contaminated soil in separate exposure. *International Journal of Phytoremediation, 16*(7-8), 694-703.

Selamat, S. N., Halmi, M. I. E. B., Abdullah, S. R. S., Idris, M., Hasan, H. A., & Anuar, N. (2018). Optimization of lead (Pb) bioaccumulation in Melastoma malabathricum L.L. by response surface methodology (RSM). *Rendiconti Lincei. Scienze Fisiche e Naturali, 29*(1), 43-51.

Salekdeh, G. H., & Komatsu, S. (2007). Crop proteomics: aim at sustainable agriculture of tomorrow. *Proteomics, 7*(16), 2976-2996.

Senn, A.C., Hug, S. J., Kaegi, R., Hering, J. G., & Voegelin, A. (2018). Arsenate co-precipitation with Fe (II) oxidation products and retention or release during precipitate aging. *Water Research, 131*, 334-345.

Sengupta, D., Kannan, M., & Reddy, A. R. (2011). A root proteomics-based insight reveals dynamic regulation of root proteins under progressive drought stress and recovery in Vigna radiata (L.) Wilczek. *Planta*, *233*(6), 1111-1127.

Ser, H. L., Tan, W. S., Cheng, H. J., Yin, W. F., Chan, K. G., Ab Mutalib, N. S., Mutalib, N.S., Goh, B.H. & Lee, L. H. (2018). Draft genome of starch-degrading actinobacterium, Microbacterium mangrovi MUSC 115T isolated from intertidal sediments. *Progress in Drug Discovery & Biomedical Science*, *1*(1).

Shah, A. (2015). Water, fish contain high level of arsenic. *New Straits Times, Pahang*.

Shakya, A. K., & Ghosh, P. K. (2018). Simultaneous removal of arsenic and nitrate in absence of iron in an attached growth bioreactor to meet drinking water standards: importance of sulphate and empty bed contact time. *Journal of Cleaner Production*, *186*, 304-312.

Shakya, A. K., & Ghosh, P. K. (2019). Stability against arsenic leaching from biogenic arsenosulphides generated under reduced environment. *Journal of Cleaner Production*, *208*, 1557-1562.

Shankar, S., & Shanker, U. (2014). Arsenic contamination of groundwater: a review of sources, prevalence, health risks, and strategies for mitigation. *The Scientific World Journal, 2014*.

Shariatpanahi, M., Anderson, A. C., Abdelghani, A. A., Englande, A. J., Hughes, J., & Wilkinson, R. F. (1981). Biotransformation of the pesticide sodium arsenate. *Journal of Environmental Science & Health Part B*, *16*(1), 35-47.

Sharma, S. B., Sayyed, R. Z., Trivedi, M. H., & Gobi, T. A. (2013). Phosphate solubilizing microbes: sustainable approach for managing phosphorus deficiency in agricultural soils. *SpringerPlus*, *2*(1), 587.

Sharmin, S. A., Alam, I., Kim, K.-H., Kim, Y.-G., Kim, P. J., Bahk, J. D., & Lee, B.-H. (2012). Chromium-induced physiological and proteomic alterations in roots of Miscanthus sinensis. *Plant Science, 187*, 113-126.

Shelake, R. M., Waghunde, R. R., Morita, E. H., & Hayashi, H. (2018). Plant-microbe-metal interactions: basics, recent advances, and future trends. In *Plant Microbiome: Stress Response* (pp. 283-305). Springer, Singapore.

Sheng, X. F., & Xia, J. J. (2006). Improvement of rape (Brassica napus) plant growth and cadmium uptake by cadmium-resistant bacteria. *Chemosphere*, *64*(6), 1036-1042.

Shishir, T., & Mahbub, N. (2019). Review on Bioremediation: A Tool to Resurrect the Polluted Rivers. *Pollution*, *5*(3), 555-568.

Shri, M., Kumar, S., Chakrabarty, D., Trivedi, P. K., Mallick, S., Misra, P., Shukla, D., Mishra, S., Srivastava, S., Tripathi, R.D. & Tuli, R. (2009). Effect of arsenic on growth, oxidative stress, and antioxidant system in rice seedlings. *Ecotoxicology and Environmental Safety*, *72*(4), 1102-1110.

Shri, M., Singh, P. K., Kidwai, M., Gautam, N., Dubey, S., Verma, G., & Chakrabarty, D. (2019). Recent advances in arsenic metabolism in plants: current status, challenges and highlighted biotechnological intervention to reduce grain arsenic in rice. *Metallomics*, *11*(3), 519-532.

Shukla, A., & Srivastava, S. (2019). A Review of Phytoremediation Prospects for Arsenic Contaminated Water and Soil. In *Phytomanagement of Polluted Sites* (pp. 243-254): Elsevier.

Shukla, D., Kesari, R., Tiwari, M., Dwivedi, S., Tripathi, R. D., Nath, P., & Trivedi, P. K. (2013). Expression of Ceratophyllum demersum phytochelatin synthase, CdPCS1, in Escherichia coli and Arabidopsis enhances heavy metal (loid) s accumulation. *Protoplasma*, *250*(6), 1263-1272.

Simiele, M., Lebrun, M., Del Cioppo, G., Scippa, S. G., Trupiano, D., Bourgerie, S., & Morabito, D. (2020). Evaluation of Different Amendment Combinations Associated with Trifolium repens to Stabilize Pb and As in a Mine-Contaminated Soil. *Water, Air, & Soil Pollution*, *231*(11), 1-15.

Singh, A., Singh, G., Singh, P., & Mishra, V. K. (2022). Biobased Technologies for Remediation: Green Technology for Environmental Cleanup. In *Innovative Bio-Based Technologies for Environmental Remediation* (pp. 89-108). CRC Press.

Singh, N. K., Gupta, G., Upadhyay, A. K., & Rai, U. N. (2018). Potentials of aquatic plants and algae for arsenic accumulation. In *Mechanisms of Arsenic Toxicity and Tolerance in Plants* (pp. 257-267). Springer, Singapore.

Singh, S., Kang, S. H., Lee, W., Mulchandani, A., & Chen, W. (2010). Systematic engineering of phytochelatin synthesis and arsenic transport for enhanced arsenic accumulation in E. coli. *Biotechnology and Bioengineering*, *105*(4), 780-785.

Singh, S., Lee, W., DaSilva, N. A., Mulchandani, A., & Chen, W. (2008). Enhanced arsenic accumulation by engineered yeast cells expressing Arabidopsis thaliana phytochelatin synthase. *Biotechnology and Bioengineering*, *99*(2), 333-340.

Singh, S., Parihar, P., Singh, R., Singh, V. P., & Prasad, S. M. (2016). Heavy metal tolerance in plants: role of transcriptomics, proteomics, metabolomics, and ionomics. *Frontiers in Plant Science*, *6*, 1143.

Smith, S. E., Christophersen, H. M., Pope, S., & Smith, F. A. (2010). Arsenic uptake and toxicity in plants: integrating mycorrhizal influences. *Plant and Soil*, *327*(1-2), 1-21.

Sofyan, N., Ridhova, A., Yuwono, A. H., Udhiarto, A., & Fergus, J. W. (2019). Synthesis of TiO2 nanoparticles at low hydrothermal temperature and its performance for DSSC sensitized using natural dye extracted from Melastoma malabathricum L.L. seeds. *International Journal of Energy Research*.

Soldan, R., Mapelli, F., Crotti, E., Schnell, S., Daffonchio, D., Marasco, R., Fusi, M., Borin, S. & Cardinale, M. (2019). Bacterial endophytes of mangrove propagules elicit early establishment of the natural host and promote growth of cereal crops under salt stress. *Microbiological Research*, *223*, 33-43.

Song, B., Xu, P., Chen, M., Tang, W., Zeng, G., Gong, J., Zhang, P. &Ye, S. (2019). Using nanomaterials to facilitate the phytoremediation of contaminated soil. *Critical Reviews in Environmental Science and Technology*, *49*(9), 791-824.

Song, F., Qi, D., Liu, X., Kong, X., Gao, Y., Zhou, Z., & Wu, Q. (2015). Proteomic analysis of symbiotic proteins of Glomus mosseae and Amorpha fruticosa. *Scientific Reports*, *5*, 18031.

Song, Y., Zhang, L. L., Li, J., He, X. J., Chen, M., & Deng, Y. (2018). High-potential accumulation and tolerance in the submerged hydrophyte Hydrilla verticillata (Lf) Royle for nickel-contaminated water. *Ecotoxicology and Environmental Safety*, *161*, 553-562.

Soni, S. K., Singh, R., Awasthi, A., & Kalra, A. (2014). A Cr (VI)-reducing Microbacterium sp. strain SUCR140 enhances growth and yield of Zea mays in Cr (VI) amended soil through reduced chromium toxicity and improves colonization of arbuscular mycorrhizal fungi. *Environmental Science and Pollution Research*, *21*(3), 1971-1979.

Souri, Z., Karimi, N., & Sandalio, L. M. (2017). Arsenic hyperaccumulation strategies: an overview. *Frontiers in Cell and Developmental Biology*, *5*, 67.

Squibb, K. S., & Fowler, B. A. (1983). The toxicity of arsenic and its compounds. *Biological and Environmental Effects of Arsenic, 233*.

Srivastava, S., & Singh, N. (2014). Mitigation approach of arsenic toxicity in chickpea grown in arsenic amended soil with arsenic tolerant plant growth promoting Acinetobacter sp. *Ecological Engineering, 70*, 146-153.

Srivastava, S., Suprasanna, P., & D'Souza, S. F. (2011). Redox state and energetic equilibrium determine the magnitude of stress in Hydrilla verticillata upon exposure to arsenate. *Protoplasma*, *248*(4), 805-815.

Srivastava, S., Verma, P. C., Chaudhry, V., Singh, N., Abhilash, P., Kumar, K. V., Sharma, N. Singh, N. (2013). Influence of inoculation of arsenic-resistant Staphylococcus arlettae on growth and arsenic uptake in Brassica juncea (L.) Czern. Var. R-46. *Journal of Hazardous Materials, 262*, 1039-1047.

Štefanić, P. P., Jarnević, M., Cvjetko, P., Biba, R., Šikić, S., Tkalec, M., Cindrić, M., Letofsky-Papst, I. & Balen, B. (2019). Comparative proteomic study of phytotoxic effects of silver nanoparticles and silver ions on tobacco plants. *Environmental Science and Pollution Research*, *26*(22), 22529-22550.

Stýblo, M., Venkatratnam, A., Fry, R. C., & Thomas, D. J. (2021). Origins, fate, and actions of methylated trivalent metabolites of inorganic arsenic: Progress and prospects. *Archives of toxicology*, *95*(5), 1547-1572.

Subba, P., Kumar, R., Gayali, S., Shekhar, S., Parveen, S., Pandey, A., Datta, A., Chakraborty, S. & Chakraborty, N. (2013). Characterisation of the nuclear proteome of a dehydration-sensitive cultivar of chickpea and comparative proteomic analysis with a tolerant cultivar. *Proteomics*, *13*(12-13), 1973-1992.

Suleiman, D., Idris, A. M. U., & Ibrahim, U. I. (2018). Review of Pharmacognostic Features, Phytochemical Constituents and Pharmacological Actions of

Melastoma malabathricum L.LINN (Melastomaceae). *Nigerian Journal of Pharmaceutical and Applied Science Research*, *7*(2), 7-18.

Suriyagoda, L. D., Dittert, K., & Lambers, H. (2018). Mechanism of arsenic uptake, translocation and plant resistance to accumulate arsenic in rice grains. *Agriculture, Ecosystems & Environment*, *253*, 23-37.

Sun, Z., Wang, L., Zhou, Q., & Huang, X. (2013). Effects and mechanisms of the combined pollution of lanthanum and acid rain on the root phenotype of soybean seedlings. *Chemosphere*, *93*(2), 344-352.

Sunilson, J., Anandarajagopal, K., Kumari, A., & Mohan, S. (2009). Antidiarrhoeal Activity of Leaves of Melastoma malabathricum L.Linn. *Indian Journal of Pharmaceutical Sciences*, *71*(6), 691.

Syam, N. (2018). Nickel Accumulation in Soybean and Melastoma on Contaminated Soil. *System*, *4*, 5.

Tang, J., Zhang, J., Ren, L., Zhou, Y., Gao, J., Luo, L., Yang, Y., Peng, Q., Huang, H. & Chen, A. (2019). Diagnosis of soil contamination using microbiological indices: A review on heavy metal pollution. *Journal of Environmental Management*, *242*, 121-130.

Tantray, A. Y., Ali, H. M., & Ahmad, A. (2020). Analysis of Proteomic Profile of Contrasting Phosphorus Responsive Rice Cultivars Grown under Phosphorus Deficiency. *Agronomy*, *10*(7), 1028.

Tara, N., Arslan, M., Hussain, Z., Iqbal, M., Khan, Q. M., & Afzal, M. (2019). On-site performance of floating treatment wetland macrocosms augmented with dye-degrading bacteria for the remediation of textile industry wastewater. *Journal of Cleaner Production*, *217*, 541-548.

Titah, H. S., Abdullah, S. R. S., Mushrifah, I., Anuar, N., Basri, H., & Mukhlisin, M. (2013). Effect of applying rhizobacteria and fertilizer on the growth of Ludwigia octovalvis for arsenic uptake and accumulation in phytoremediation. *Ecological Engineering*, *58*, 303-313.

Titah, H. S., Abdullah, S. R. S., Mushrifah, I., Anuar, N., Basri, H., & Mukhlisin, M. (2014). Phytotoxicity and uptake of arsenic by Ludwigia octovalvis in a pilot reed bed system. *Environmental Engineering Science*, *31*(2), 71-79.

Titah, H. S., Halmi, M. I. E. B., Abdullah, S. R. S., Hasan, H. A., Idris, M., & Anuar, N. (2018). Statistical optimization of the phytoremediation of arsenic by Ludwigia octovalvis-in a pilot reed bed using response surface methodology

(RSM) versus an artificial neural network (ANN). *International Journal of Phytoremediation*, *20*(7), 721-729.

Tu, C., & Ma, L. Q. (2002). Effects of arsenic concentrations and forms on arsenic uptake by the hyperaccumulator ladder brake. *Journal of Environmental Quality*, *31*(2), 641-647.

Tu, C., Ma, L. Q., & Bondada, B. (2002). Arsenic accumulation in the hyperaccumulator Chinese brake and its utilization potential for phytoremediation. *Journal of Environmental Quality*, *31*(5), 1671-1675.

Ullah, A., Heng, S., Munis, M. F. H., Fahad, S., & Yang, X. (2015). Phytoremediation of heavy metals assisted by plant growth promoting (PGP) bacteria: a review. *Environmental and Experimental Botany*, *117*, 28-40.

Ungureanu, G., Santos, S., Boaventura, R., & Botelho, C. (2015). Arsenic and antimony in water and wastewater: overview of removal techniques with special reference to latest advances in adsorption. *Journal of Environmental Management*, *151*, 326-342.

Uppal, H., Chawla, S., Joshi, A. G., Haranath, D., Vijayan, N., & Singh, N. (2019). Facile chemical synthesis and novel application of zinc oxysulfide nanomaterial for instant and superior adsorption of arsenic from water. *Journal of Cleaner Production*, *208*, 458-469.

Valenzuela-Aragon, B., Parra-Cota, F. I., Santoyo, G., Arellano-Wattenbarger, G. L., & de los Santos-Villalobos, S. (2019). Plant-assisted selection: a promising alternative for in vivo identification of wheat (Triticum turgidum L. subsp. Durum) growth promoting bacteria. *Plant and Soil*, *435*(1-2), 367-384.

Van den Berg, R. A., Hoefsloot, H. C., Westerhuis, J. A., Smilde, A. K., & van der Werf, M. J. (2006). Centering, scaling, and transformations: improving the biological information content of metabolomics data. *BMC Genomics*, *7*(1), 142.

Van Der Heijden, M. G., Bardgett, R. D., & Van Straalen, N. M. (2008). The unseen majority: soil microbes as drivers of plant diversity and productivity in terrestrial ecosystems. *Ecology Letters, 11*(3), 296-310.

Vega-Hernandez, S., Weijma, J., & Buisman, C. J. (2019). Immobilization of arsenic as scorodite by a thermoacidophilic mixed culture via As (III)-catalyzed oxidation with activated carbon. *Journal of Hazardous Materials, 368*, 221-227.

Verbruggen, N., Hermans, C., & Schat, H. (2009). Mechanisms to cope with arsenic or cadmium excess in plants. *Current Opinion in Plant Biology*, *12*(3), 364-372.

Verma, J. P., Yadav, J., Tiwari, K. N., Lavakush, S., & Singh, V. (2010). Impact of plant growth promoting rhizobacteria on crop production. *International Journal of Agricultural Research*, *5*(11), 954-983.

Verma, S., Verma, P. K., Meher, A. K., Bansiwal, A. K., Tripathi, R. D., & Chakrabarty, D. (2018). A novel fungal arsenic methyltransferase, WaarsM reduces grain arsenic accumulation in transgenic rice (Oryza sativa L.). *Journal of Hazardous Materials*, *344*, 626-634.

Vinodkumar, S., Nakkeeran, S., Renukadevi, P., & Mohankumar, S. (2018). Diversity and antiviral potential of rhizospheric and endophytic Bacillus species and phyto-antiviral principles against tobacco streak virus in cotton. *Agriculture, Ecosystems & Environment*, *267*, 42-51.

Visoottiviseth, P., Francesconi, K., & Sridokchan, W. (2002). The potential of Thai indigenous plant species for the phytoremediation of arsenic contaminated land. *Environmental Pollution*, *118*(3), 453-461.

Vromman, D., Lutts, S., Lefèvre, I., Somer, L., De Vreese, O., Šlejkovec, Z., & Quinet, M. (2013). Effects of simultaneous arsenic and iron toxicities on rice (Oryza sativa L.) development, yield-related parameters and As and Fe accumulation in relation to As speciation in the grains. *Plant and Soil*, *371*(1-2), 199-217.

Vurukonda, S. S. K. P., Vardharajula, S., Shrivastava, M., & SkZ, A. (2016). Enhancement of drought stress tolerance in crops by plant growth promoting rhizobacteria. *Microbiological Research*, *184*, 13-24.

Wang, C., Liu, H., Zhang, Y., Zou, C., & Anthony, E. J. (2018). Review of arsenic behavior during coal combustion: Volatilization, transformation, emission and removal technologies. *Progress in Energy and Combustion Science*, *68*, 1-28.

Wang, C., Na, G., Bermejo, E. S., Chen, Y., Banks, J. A., Salt, D. E., & Zhao, F. J. (2018). Dissecting the components controlling root-to-shoot arsenic translocation in Arabidopsis thaliana. *New Phytologist*, *217*(1), 206-218.

Wang, M. C., Peng, Z. Y., Li, C. L., Li, F., Liu, C., & Xia, G. M. (2008). Proteomic analysis on a high salt tolerance introgression strain of Triticum aestivum/Thinopyrum ponticum. *Proteomics*, *8*(7), 1470-1489.

Wang, J., Zhang, T., Li, M., Yang, Y., Lu, P., Ning, P., & Wang, Q. (2018). Arsenic removal from water/wastewater using layered double hydroxide derived adsorbents, a critical review. *RSC Advances*, *8*(40), 22694-22709.

Wang, J., Zhao, F. J., Meharg, A. A., Raab, A., Feldmann, J., & McGrath, S. P. (2002). Mechanisms of arsenic hyperaccumulation in Pteris vittata. Uptake kinetics, interactions with phosphate, and arsenic speciation. *Plant Physiology*, *130*(3), 1552-1561.

Wang, P., Chen, X., Xu, X., Lu, C., Zhang, W., & Zhao, F. J. (2018). Arsenate induced chlorosis 1/translocon at the outer envolope membrane of chloroplasts 132 protects chloroplasts from arsenic toxicity. *Plant Physiology*, *178*(4), 1568-1583.

Wang, Q., Ma, L., Zhou, Q., Chen, B., Zhang, X., Wu, Y., Pan, F., Huang, L., Yang, X. & Feng, Y. (2019). Inoculation of plant growth promoting bacteria from hyperaccumulator facilitated non-host root development and provided promising agents for elevated phytoremediation efficiency. *Chemosphere*, *234*, 769-776.

Wang, Q., Xiong, D., Zhao, P., Yu, X., Tu, B., & Wang, G. (2011). Effect of applying an arsenic-resistant and plant growth–promoting rhizobacterium to enhance soil arsenic phytoremediation by Populus deltoides LH05-17. *Journal of Applied Microbiology*, *111*(5), 1065-1074.

Wang, Y., Hu, H., Zhu, L.-Y., & Li, X.-X. (2012). Response to nickel in the proteome of the metal accumulator plant Brassica juncea. *Journal of Plant Interactions*, *7*(3), 230-237.

Watanabe, T., Misawa, S., Hiradate, S., & Osaki, M. (2008). Root mucilage enhances aluminum accumulation in Melastoma malabathricum, an aluminum accumulator. *Plant Signaling & Behavior*, *3*(8), 603-605.

Watanabe, T., Osaki, M., & Tadano, T. (1997). Aluminum-induced growth stimulation in relation to calcium, magnesium, and silicate nutrition in Melastoma malabathricum L.L. *Soil Science and Plant Nutrition*, *43*(4), 827-837.

Watanabe, T., Osaki, M., Yoshihara, T., & Tadano, T. (1998). Distribution and chemical speciation of aluminum in the Al accumulator plant, Melastoma malabathricum L.L. *Plant and Soil, 201*(2), 165-173.

Wu, C., Zou, Q., Xue, S., Mo, J., Pan, W., Lou, L., & Wong, M. H. (2015). Effects of silicon (Si) on arsenic (As) accumulation and speciation in rice (Oryza sativa L.) genotypes with different radial oxygen loss (ROL). *Chemosphere, 138*, 447-453.

Wheelock, Å. M., & Wheelock, C. E. (2013). Trials and tribulations of ‘omics data analysis: assessing quality of SIMCA-based multivariate models using examples from pulmonary medicine. *Molecular BioSystems*, *9*(11), 2589-2596.

Worley, B., & Powers, R. (2013). Multivariate analysis in metabolomics. *Current Metabolomics*, *1*(1), 92-107.

Xia, J., Sinelnikov, I. V., Han, B., & Wishart, D. S. (2015). MetaboAnalyst 3.0—making metabolomics more meaningful. *Nucleic Acids Research*, *43*(W1), W251-W257.

Xu, J. Y., Han, Y. H., Chen, Y., Zhu, L. J., & Ma, L. Q. (2016). Arsenic transformation and plant growth promotion characteristics of As-resistant endophytic bacteria from As-hyperaccumulator Pteris vittata. *Chemosphere*, *144*, 1233-1240.

Xu, Y., Li, J., Xia, W., Sun, Y., Qian, G., & Zhang, J. (2019). Enhanced remediation of arsenic and chromium co-contaminated soil by eletrokinetic-permeable reactive barriers with different reagents. *Environmental Science and Pollution Research*, *26*(4), 3392-3403..

Yahaghi, Z., Shirvani, M., Nourbakhsh, F., De La Pena, T. C., Pueyo, J. J., & Talebi, M. (2018). Isolation and characterization of Pb-solubilizing bacteria and their effects on Pb uptake by Brassica juncea: implications for microbe-assisted phytoremediation. *Journal of Microbiology and Biotechnology*, *28*(7), 1156-1167.

Yahaghi, Z., Shirvani, M., Nourbakhsh, F., & Pueyo, J. J. (2019). Uptake and effects of lead and zinc on alfalfa (Medicago sativa L.) seed germination and seedling growth: Role of plant growth promoting bacteria. *South African Journal of Botany*, *124*, 573-582.

Yan, H., Gao, Y., Wu, L., Wang, L., Zhang, T., Dai, C., Xu, W., Feng, L., Ma, M., Zhu, Y.G.& He, Z. (2019). Potential use of the Pteris vittata arsenic hyperaccumulation-regulation network for phytoremediation. *Journal of Hazardous Materials*, *368*, 386-396.

Yan, Y., Zhang, X., Zheng, X., Apaliya, M. T., Yang, Q., Zhao, L., Xu, W., Feng, L., Ma, M., Zhu, Y.G. & Zhang, H. (2018). Control of postharvest blue mold decay in pears by Meyerozyma guilliermondii and it's effects on the protein expression profile of pears. *Postharvest Biology and Technology*, *136*, 124-131.

Yang, D., Sasaki, A., & Endo, M. (2019). Reclamation of a waste arsenic-bearing gypsum as a soil conditioner via acid treatment and subsequent Fe (II) As stabilization. *Journal of Cleaner Production*, *217*, 22-31.

Yang, H. C., Fu, H. L., Lin, Y. F., & Rosen, B. P. (2012). Pathways of arsenic uptake and efflux. In *Current topics in membranes* (Vol. 69, pp. 325-358). Academic Press.

Yang, J., You, S., & Zheng, J. (2019, March). Review in strengthening technology for phytoremediation of soil contaminated by heavy metals. In *IOP Conference Series: Earth and Environmental Science* (Vol. 242, No. 5, p. 052003). IOP Publishing.

Yang, Y., Wei, X., Lu, J., You, J., Wang, W., & Shi, R. (2010). Lead-induced phytotoxicity mechanism involved in seed germination and seedling growth of wheat (Triticum aestivum L.). *Ecotoxicology and Environmental Safety*, *73*(8), 1982-1987.

Yap, C. K., & Pang, B. H. (2011). Assessment of Cu, Pb, and Zn contamination in sediment of north western Peninsular Malaysia by using sediment quality values and different geochemical indices. *Environmental Monitoring and Assessment*, *183*(1-4), 23-39.

Yañez, L. M., Alfaro, J. A., Carreras, N. A., & Mitre, G. B. (2019). Arsenic accumulation in lettuce (Lactuca sativa L.) and broad bean (Vicia faba L.) crops and its potential risk for human consumption. *Heliyon*, *5*(1), e01152.

Yasin, N. A., Khan, W. U., Ahmad, S. R., Ahmad, A., Akram, W., & Ijaz, M. (2018). Role of Acinetobacter sp. CS9 in improving growth and phytoremediation potential of Catharanthus longifolius under cadmium stress. *Polish Journal of Environmental Studies*, *28*(1), 435-443.

Yeo, C. K., & Tan, H. T. W. (2011). Ficus stranglers and Melastoma malabathricum: Potential tropical woody plants for phytoremediation of metals in wetlands. *Nature in Singapore*, *4*, 213-226.

Yin, H., Kong, M., Gu, X., & Chen, H. (2017). Removal of arsenic from water by porous charred granulated attapulgite-supported hydrated iron oxide in bath and column modes. *Journal of Cleaner Production*, *166*, 88-97.

Yin, X. X., Chen, J., Qin, J., Sun, G. X., Rosen, B. P., & Zhu, Y. G. (2011). Biotransformation and volatilization of arsenic by three photosynthetic cyanobacteria. *Plant Physiology*, *156*(3), 1631-1638.

Yong, W. T. L., Chang, J. L. J., Thien, V. Y., Chong, H. L. H., & Abdullah, J. O. Uptake and Accumulation of Aluminium, Copper and Cobalt in Tissue Cultured Melastoma malabathricum L.Linn. Plantlets.

Yoon, J., Cao, X., Zhou, Q., & Ma, L. Q. (2006). Accumulation of Pb, Cu, and Zn in native plants growing on a contaminated Florida site. *Science of the Total Environment*, *368*(2-3), 456-464.

Yoshida, T., Sakuma, Y., Todaka, D., Maruyama, K., Qin, F., Mizoi, J., Kidokoro, S., Fujita, Y., Shinozaki, K. & Yamaguchi-Shinozaki, K. (2008). Functional analysis of an Arabidopsis heat-shock transcription factor HsfA3 in the transcriptional cascade downstream of the DREB2A stress-regulatory system. *Biochemical and Biophysical Research Communications*, *368*(3), 515-521.

Yuan, C., & Chiang, T.-S. (2007). The mechanisms of arsenic removal from soil by electrokinetic process coupled with iron permeable reaction barrier. *Chemosphere*, *67*(8), 1533-1542.

Zaheer, I. E., Ali, S., Rizwan, M., Farid, M., Shakoor, M. B., Gill, R. A., Najeeb, U., Iqbal, N. & Ahmad, R. (2015). Citric acid assisted phytoremediation of copper by Brassica napus L. *Ecotoxicology and Environmental Safety*, *120*, 310-317.

Zakhar, R., Derco, J., & Čacho, F. (2018). An overview of main arsenic removal technologies. *Acta Chimica Slovaca*, *11*(2), 107-113.

Zeng, X., Pang, L., Chen, Y., Kong, X., Chen, J., & Tian, X. (2020). Bacteria Sphingobium yanoikuyae Sy 310 enhances accumulation capacity and tolerance of cadmium in Salix matsudana Koidz roots. *Environmental Science and Pollution Research*, 1-10.

Zhang, J., Cao, T., Tang, Z., Shen, Q., Rosen, B. P., & Zhao, F. J. (2015). Arsenic methylation and volatilization by arsenite S-adenosylmethionine methyltransferase in Pseudomonas alcaligenes NBRC14159. *Applied and Environmental Microbiology*, *81*(8), 2852-2860.

Zhang, Q., Zhao, L., Li, B., Gu, X., Zhang, X., Boateng, N. A. S., & Zhang, H. (2020). Molecular Dissection of Defense Response of Pears Induced by the Biocontrol Yeast, Wickerhamomyces anomalus Using Transcriptomics and Proteomics Approaches. *Biological Control*, 104305.

Zhang, X., Li, X., Yang, H., & Cui, Z. (2018). Biochemical mechanism of phytoremediation process of lead and cadmium pollution with Mucor circinelloides and Trichoderma asperellum. *Ecotoxicology and Environmental Safety*, *157*, 21-28.

Zhang, X., Wu, F., Gu, N., Yan, X., Wang, K., Dhanasekaran, S., Gu, X., Zhao, L.& Zhang, H. (2020). Postharvest biological control of Rhizopus rot and the mechanisms involved in induced disease resistance of peaches by Pichia membranefaciens. *Postharvest Biology and Technology*, *163*, 111146.

Zhang, Y. Y., Yang, J., Yin, X. X., Yang, S. P., & Zhu, Y. G. (2012). Arsenate toxicity and stress responses in the freshwater ciliate Tetrahymena pyriformis. *European Journal of Protistology*, *48*(3), 227-236.

Zhao, F. J., Dunham, S. J., & McGrath, S. P. (2002). Arsenic hyperaccumulation by different fern species. *New Phytologist*, *156*(1), 27-31.

Zhao, L., Sun, Y. L., Cui, S. X., Chen, M., Yang, H. M., Liu, H. M., Chai, T.Y. & Huang, F. (2011). Cd-induced changes in leaf proteome of the hyperaccumulator plant Phytolacca americana. *Chemosphere*, *85*(1), 56-66.

Zheng, J., Zhang, K., Liu, Y., & Wang, Y. (2019). Fatal acute arsenic poisoning by external use of realgar: Case report and 30 years literature retrospective study in China. *Forensic Science International*, *300*, e24-e30.

Zheng, T., Lin, Y., Wang, L., Lin, Q., Lin, X., Chen, Z., & Lin, Z. (2019). De novo assembly and characterization of the floral transcriptomes of two varieties of Melastoma malabathricum. *Frontiers in Genetics*, *10*, 521.

Zhou, C., Huang, M., Li, Y., Luo, J., & ping Cai, L. (2016). Changes in subcellular distribution and antioxidant compounds involved in Pb accumulation and detoxification in Neyraudia reynaudiana. *Environmental Science and Pollution Research*, *23*(21), 21794-21804.

Zhou, M. X., Li, G. H., Wu, X. Y., Sun, L., Li, Y. R., Yang, W. J., Ren, D.M., Wang, X.N., Xiang, L., Lou, H.X. & Shen, T. (2019). (2S)-5, 6, 7, 3′, 4′-pentamethoxyflavanone, a citrus polymethoxyflavone ameliorates arsenic- and cigarette smoke extract-induced cytotoxicity via activating Nrf2-mediated defense system. *Journal of Functional Foods*, *54*, 337-347.

Zhu, Y. G., Xue, X. M., Kappler, A., Rosen, B. P., & Meharg, A. A. (2017). Linking genes to microbial biogeochemical cycling: lessons from arsenic. *Environmental Science & Technology*, *51*(13), 7326-7339.

Zvobgo, G., LwalabaWaLwalaba, J., Sagonda, T., Mapodzeke, J. M., Muhammad, N., Shamsi, I. H., & Zhang, G. (2018). Phosphate alleviates arsenate toxicity by altering expression of phosphate transporters in the tolerant barley genotypes. *Ecotoxicology and Environmental Safety*, *147*, 832-839.

LIST OF PUBLICATIONS

1. Alka, S., Shahir, S., Ibrahim, N., Chai, T. T., Bahari, Z. M., & Abd Manan, F. (2020). The role of plant growth promoting bacteria on arsenic removal: a review of existing perspectives. *Environmental Technology & Innovation*, *17*, 100602. **[Q1- Elsevier].**

2. Alka, S., Shahir, S., Ibrahim, N., Ndejiko, M. J., Vo, D. V. N., & Abd Manan, F. (2021). Arsenic removal technologies and future trends: A mini review. *Journal of Cleaner Production*, *278*, 123805. **[Q1- Elsevier].**

3. Alka, S., Shahir, S., Ibrahim, N., Rahmad, N., Haliba, N., & Abd Manan, F. (2021). Histological and proteome analyses of *Microbacterium foliorum*-mediated decrease in arsenic toxicity in *Melastoma malabathricum*. *3 Biotech*, *11*(7), 1-17. **[Q3-Springer].**

4. Assessment of plant growth promotion properties and impact of *Microbacterium foliorum* for arsenic removal in *Melastoma malabathricum* *(Under review)* **[Submitted to Bioremediation journal–Q4)**