EFFECT OF PrekotAC ON PRESSURE DROP AND PARTICLE PENETRATION IN FILTRATION SYSTEM

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SUMMARY: The effect of a filter aids known as PrekotAC on pressure drop and particle penetration in a filtration system with varying filtration velocity of 1 to 5 m/min was evaluated in this study. The PrekotAC is a combination of Prekot™ and activated carbon mixed in different weight composition. The result showed that the pressure drop across the fabric media decreases with the addition of Prekot™ in the PrekotAC admixture due to its wide range of non-uniform particle size ditribution that gives higher porosity of filter cake during filtration process. The study also showed that the total particle penetration through the fabric media was proportionally related to addition of Prekot™ in the PrekotAC admixture under a constant material loading. The study suggests that the addition of Prekot™ in the formulation of filter aids significantly affect both pressure drop and penetration of the fabric filter media.

***Keywords*—**Filter aids, Precoating material, Fabric filtration, Pressure drop, Penetration

1.0 INTRODUCTION

Fabric filtration has been used as an air pollution control system because of its excellent separation efficiencies even for ultrafine dust particles. [1]. In addition, filtration possesses several advantages such as ease of installation and operation. Flue gas cleaning agents such as activated carbon and lime are normally used along with fabric filtration for air emission control especially in waste incineration processes. However, the life span of the fabric filter is usually shorten and influenced by the variations of the flue gas as well as the operating conditions of the process. This deteriorates its filtration performance with time and simultaneously increasing the maintenance cost having to replace it within a short period of time.

To minimize the problem the use of so 'pre-coat' agent or filtration aids to coat a layer of inert material onto the fabric as a barrier of protection is applied. PrekotAC is a newly developed filtration aids consisting of a combination of pre-coating material (i.e Prekot™) and activated carbon. Filter aids has been applied in the air filtration system in order to increase the collection efficiency during the filtration process. Filter aids consisting of a group of inert materials used to coat the fabric as a 'barrier' for protection as well as to allow a uniform air flow passing through the filter cake [2].

The filter cake that deposited on the surface of the filter media acts as a new filter media that helps to increase the filtration efficiency. However, during cake filtration process, some particles do not participate in the formation of the filter cake. The particles either penetrating through the filter media or clog and block the pores of the filter media. Therefore, understanding the parameters effecting the filtration efficiency is important in determining the characteristics of the filter aids where high performance filtration requires low particle penetration without excessive pressure drop builds up across the filter media [3].

This paper presents on the effect of using filtration aids PrekotAC on the particle penetration and pressure drop across a fabric media with material loadings of 0.2 mg/mm² tested under low filtration velocites from 1 to 5 m/min. A detailed results of the study is presented in this paper.

2.0 MATERIALS AND METHODS

Activated Carbon and PreKot™

A powder form coconut based activated carbon and PreKot™ was used in this study. Filtration aids was formulated by mixing the adsorbent activated carbon with the pre-coating material PreKot™ in four different proportion of Prekot™ from 10, 20, 30 and 40% by weight. Both activated carbon and PreKot™ were dried in an oven at 105°C for 24 hours before mixing.

The Filtration Test System

The filtration system is composed of two cylinders with a dust feeder on the top and a filter holder in between of the two cylinders. The pressure drop across the filter media was measured using a digital pressure manometer (Extech Instruments, Model HD755) recorded at different filtration velocities from 1 m/min to 5 m/min with constant filtration aids dust loading of 0.2 mg/mm². The particle count penetration was monitored using GRIMM Aerosol

Portable Laser Aerosol Spectrometer (GRIMM, Model 1.109).

3. RESULTS AND DISCUSSION

Pressure Drop

Fig. 1 presents the pressure drop across the fabric media against the filtration velocity which showed a consistent trend with the admixture of filter aids having lower pressure drop compared to activated carbon alone. It is observed that the addition of PreKot™ in the admixture resulted in a lower pressure drop across the fabric due to increase in the porosity of the filter cake during the filtration process. Hajar et al., [2] stated that the particulate size distribution plays a substantial role in decreasing the pressure drop with the addition of PreKot™ in the admixture. The latter has a wider range of non-uniform particle size distribution compared to activated carbon that contributes to this effect.

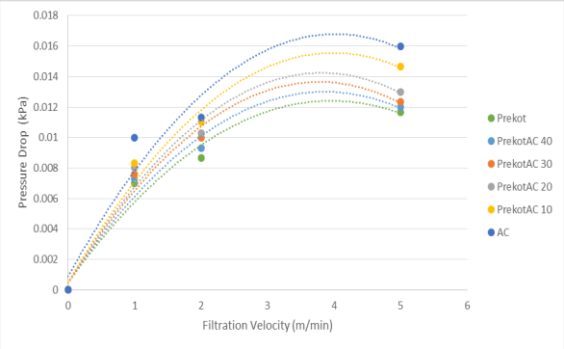

Fig.1 Pressure drop under different filtration velocity.

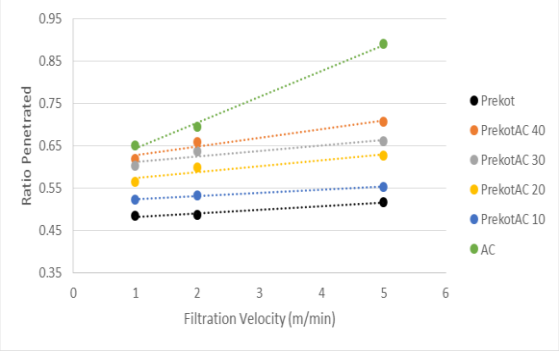

Fig.2 Particle penetration under different filtration velocity.

Particle Penetration

Fig. 2 presents the ratio particle penetration through a fabric media with the introduction of filtration aids materials under different filtration velocities from 1 to 5 m/min. Ratio particle penetration (Rpp) is define as number of penetrated particle before divided by the number of particle penetrated after the addition of the filtration aids across the fabric media. Rpp <1.0 indicates that less number of particle penetrated through the fabric media. As expected (Fig. 2) the Rpp increases with filtration velocity illustrating that more particles are able to penetrate through the media under high filtration velocity. PreKot™ has the lowest number of particles penetrated through the fabric media in all cases while activated carbon presents the highest. Again, the characteristics of the material in terms of its particle size distribution is the reason for the finding. Activated carbon has more than 80% of particles ≤75 µm compared to PreKot™ only 20% of it is particles ≤75 µm. Thus, it is expected that activated carbon which predominantly consists of fine particles has higher number of penetrated particles compared to PreKot™. However for admixture, PrekotAC 10:90 has the lowest while PrekotAC 40:60 retains the highest total penetrated particles under a constant material loading. It was found that, the high porosity and multi cellular shape of the Prekot™ leads to higher particle penetration since fine particles can easily passing through the material under high filtration velocity. Hence, it was observed that the higher the ratio of Prekot™ contained in the PrekotAC is, the bigger the total penetration becomes.

As discuss earlier, the penetration is influenced by the filtration velocity used during the filtration process. The number of particles penetrating through the fabric media increases when the filtration velocity increases from 1 to 5 m/min. A higher filtration velocity leads to a bigger driving force causing more particles to pass through the open pores of the fabric media as observed in the study. Similarly, Simon et al. [4] found that particle penetration at a lower filtration velocity is less compared to the particle penetration at higher filtration velocity which force fine particles to easily permeate deep into the pores of the filter media and influence the total number of penetration.

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