transition that shrinks the starch's crystallites. This hydroxyl group caused the increased film strength. The high concentration of plasticizer (in the case of; glycerol) decreased the molecule's surface tension that arranged matrix film, thus decreasing edible film [25]. Fig. 5 (a and b) illustrates that the concentration of citric acid has not significantly affected tensile strength.

From Fig. 6 (a, b and c) illustrates that the concentration of plasticizer and filler has a significant effect on tensile strength. It was also reported by another studies [15], [23] where they mentioned glycerol and sorbitol contributed through hydrogen bonding to make a strong interaction bonding between polymer and plasticizer. Moreover, Martinez *et al.,* [15] reported that the increasing concentration of sorbitol or glycerol can decrease the puncture strength since the plasticizer affects the movement of the polymer chains.

The dome graphs display high tensile strength in higher plasticizers (in terms of sorbitol) and filler (MCC). Maximum tensile strength was achieved at 30% plasticizer and 20% filler for 15.84 MPa in the dome's peak whereas from the center point. The citric acid (3-9%) depicts that the higher concentration of citric acid has not significantly affected tensile strength.

IV. Conclusions

The model equation for tensile strength by using glycerol as plasticizer and CMC as filler (Y_1) and sorbitol as plasticizer and MCC as a filler (Y_2) are given in Equations 2 and 3, respectively. It was found that citric acid as cross-linking agent has higher tensile strength than without citric acid and that sorbitol and microcrystalline cellulose (MCC) has higher tensile strength than glycerol and carboxymethylcellulose (CMC). Also, it showed that plasticizer concentration had a significant effect on tensile strength. The best edible film composition consists of microcrystalline cellulose (MCC) 20% w/w, sorbitol 30% w/w with citric acid 0.95% w/w. The best tensile strength value was 15.84 MPa.

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