CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The studies carried out were on the investigation of effects of scallop formation formed on the surface of plaster pipe. Dissolution of plaster, pressure drop, characteristics of scallops and mechanism of gypsum dissolution were observed. Flow rate affected the scallop initiation more significantly than pH. The average size of scallops was found to decrease with increasing water flow rate and the population of scallops was observed to develop significantly with increasing fluid flow rate. pH does not have any effect on dissolution rate of gypsum nor on the pressure drop. Flow rate has a significant effect on the dissolution rate of plaster pipe. Pressure drop and flow rate are dependent on each other - higher flow rate gives greater pressure drop. The mechanism of dissolution of gypsum is controlled by mixed kinetics. Flow rate, surface roughness and temperature have a significant effects while flow disturbances at the entrance section of the pipe also affects the mechanism.

Size and concentration of initial defects strongly affect the size and population of scallops, confirming the Defect theory. They also have a significant effect on the dissolution rate with time and dissolution rate along the pipe. Moreover, diameter of pipe has greater effect than the surface roughness on the pressure drop.

The population of scallops decreases with decreasing temperature which leads to the decrease in dissolution rate. Temperature also has an effect on pressure drop.

Dissolution rate could be changed more than 50% by increasing temperature, whereas dissolution rate could be changed more than 40% by increasing flow rate. This indicates that temperature has more effect on the dissolution rate than the effect of flow rate. Moreover, defect concentration has greater effect on dissolution rate than the defect size. This means more scallops can be initiated by increasing defect concentration than by increasing size of defects. Consequently, surface area of plaster and dissolution rate more increase. This supports the Defect theory.

5.2 Recommendations

Through the experiments, there are some recommendations for the future work. Other chemicals should be used to adjust pH to determine the dissolution rate if pH is the only variable. The effects of temperature and flow rate on the dissolution rate and scallop characteristics should be investigated to determine the scalloping phenomenon at different ranges of temperatures and flow rates. Other shapes of the pipe, such as the bending or the connection parts, should be investigated to observe the characteristics of scallops and rates of dissolution. The different ratios between water and plaster of Paris should be studied in the same conditions to observe the effect of this ratio on dissolution rate and scalloping under similar conditions. Other types of plaster of Paris should be investigated under the same conditions to determine if materials are a significant variable.