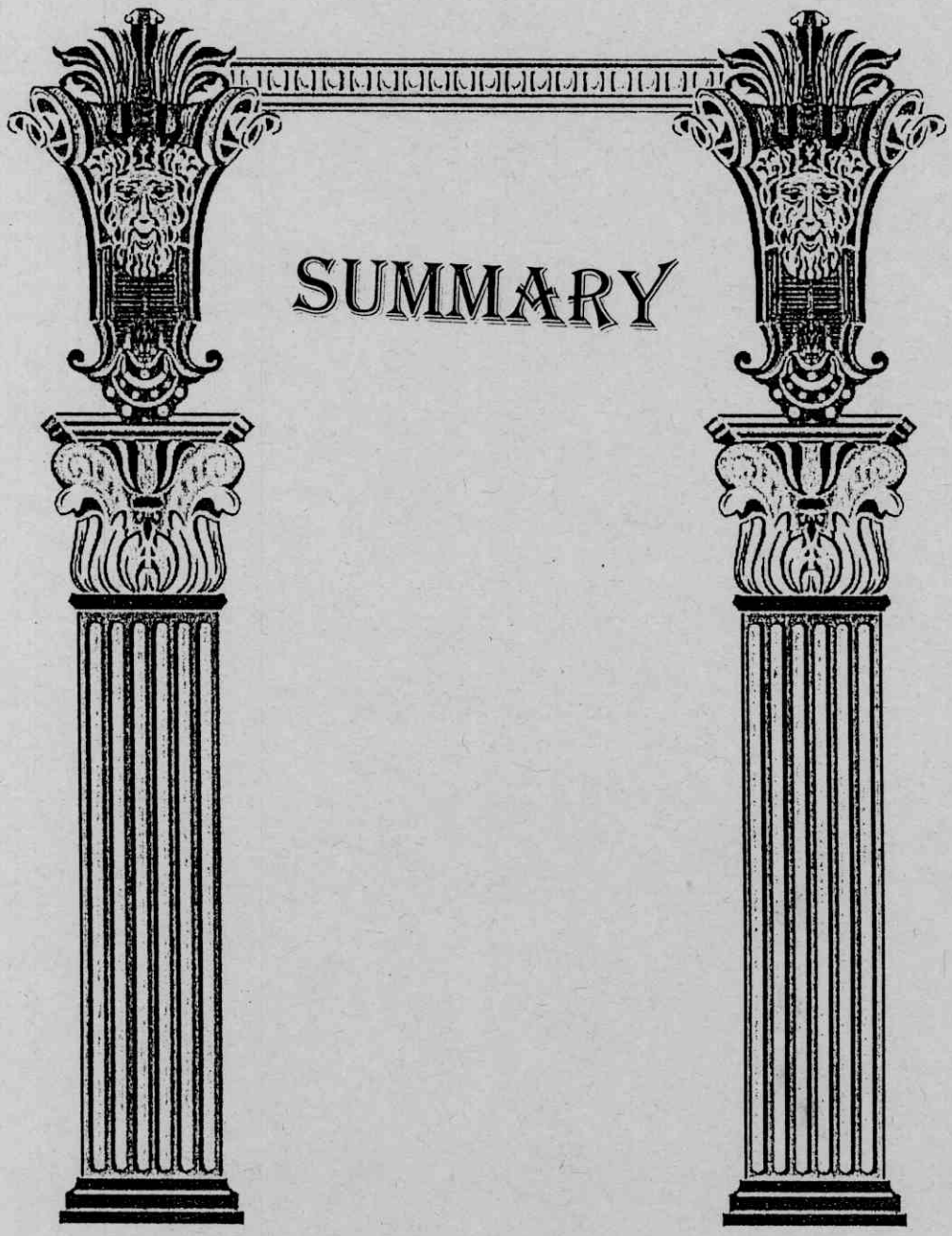

SUMMARY

5. SUMMARY

In the present work, the lignocellulosic material of sugarcane bagasse has been investigated and more information was obtained about their pretreatment and chemical features of this agricultural waste. Besides, cellulase and hemicellulase complex enzymes were produced from *Aspergillus niger* and *Trichoderma harzianum* then evaluated to obtain their optimum conditions. Also, saccharification processes were carried out using the produced cellulase and hemicellulase enzymes to convert extracted cellulose and isolated hemicellulose of the abovementioned lignocellulosic material to reducing sugar (cellobiose and glucose) and xylose syrups.

The obtained results indicated that sugarcane bagasse contained a high percentage of cellulose and isolated hemicellulose (43.5%, 30.4%). Pretreatment of lignocellulosic materials with NaOH was achieved to convert the crystallinity structure of these polymers to amorphous state to enhance the enzymatic attack toward these polysaccharides.

The results indicated that pretreatment of lignocellulosic materials with NaOH showed a higher yield of cellulose .

Production of cellulase and hemicellulase enzymes using different media of fungi to obtain maximum amount of them. The best results of enzymes production was recorded by using modified of Park medium after 9 days fermintation period.

The stability of the produced enzymes were evaluated to obtain the maximum stability after 48 hr. and then minimized after 96 hr.

By using different parameters which effect on the reaction activity of the produced cellulase and hemicellulase enzymes it was concluded that the effect of temperature on the activity of cellulase and hemicellulase enzymes were evaluated. The optimum temperature was 50°C , and the reaction activity of cellulase enzyme reached its maximum i.e. 164 and 175 uM/l/min when using *A. niger* and *T. harzianum* respectivey. While the reaction activity of hemicellulase enzyme reached its maximum i.e. 19 and 19.7 uM/l/min when using *A. niger* and *T. harzianum,* respectivey.

While the effect of pH values on the enzyme activity on the same above mentioned enzymes indicated that the optimum pH was 4.8 for cellulase enzyme while pH 5.0 for hemicellulase enzyme .

On the other hand, the effect of enzyme concentration on the relative activity by using carboxymethyl cellulose (CMC) as standard and the extracted cellulose and isolated hemicellulose were studied. The obtained results indicated that the reaction activity of cellulase reached its maximum at enzyme concentration equaled to 1200 µL/100ml buffer. However the maximum reaction activity of the produced hemicellulase equaled with enzyme concentration 1000 µL/100mL buffer.

The effect of substrate concentration using CMC as standard and extracted cellulose of lignocellulosic materials on

the activity of cellulase enzyme indicated that the maximum reaction velocity (V_{max}) of CMC were 158.0 μmM/L/min with *A. niger* and 24.4 μmM/L/min with *T. harzianum* while were 46.9 μmM/L/min with *A. niger* and 20.0 μmM/L/min *with T. harzianum* for extracted cellulose from sugarcane bagasse.

On the other hand, Michelis constant (K_m) values of cellulase for CMC and extracted cellulose were 2 and 5.5 g/100ml with *A. niger* while were 5.2 and 6.6 g/100ml with *T. harzianum.*

While, the effect of substrate concentration using xylan as standard and isolated hemicellulose of lignocellulosic materials on the reaction activity of hemicellulase enzyme indicated that the maximum reaction velocity (V_{max}) of xylan were 25.3 μmM/L/min with *A. niger* and 168.2 μmM/L/min with *T. harzianum* while were 20.9 μmM/L/min with *A. niger* for xylan and 44.8 μmM/L/min *with T. harzianum* for isolated hemicellulose.

On the other hand, Michelis constant (K_m) values of hemicellulase for xylan and isolated hemicellulose were 4.3 and 4.6 g/100ml with *A. niger* while were 3.4 and 6.5 g/100ml with *T. harzianum*

The acquired results of saccharification process for lignocellulosic materials indicated that the maximum values of saccharification process for cellulose from sugarcane bagasse at substrate concentration 250 g / l after 96 hr. under optimum conditions of cellulase enzyme were 61.5 and 68% by using *A. niger* and *T. harzianum,* respectively.

While the maximum values of saccharification process for isolated hemicellulose from sugarcane bagasse at substrate concentration of 250g/l after 96 hr. under optimum conditions of hemicellulase enzyme were 31.2 and 27% when using *A. niger* and *T. harzianum,* respectively.