



REMOVAL OF VANCOMYCIN FROM WATER BY ADSORPTION USING SAWDUST

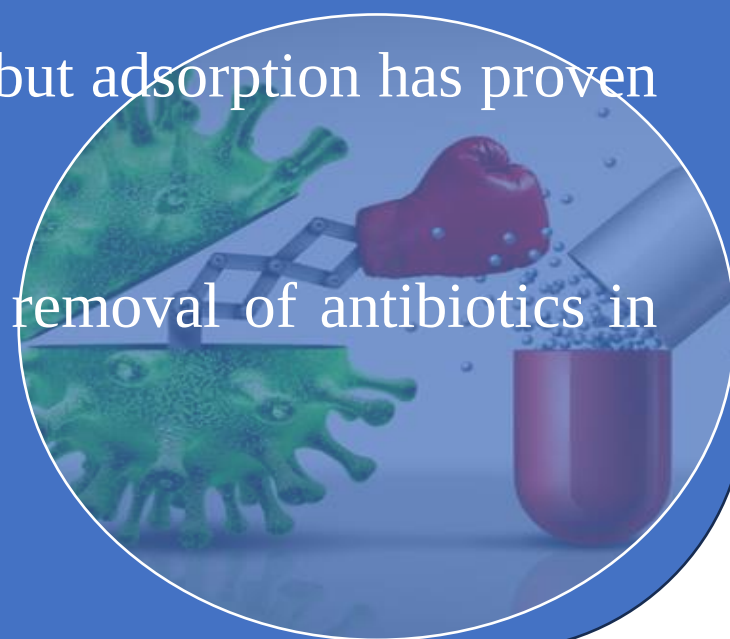
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1. BACKGROUND

- ❖ Antibiotic resistance has been one of the leading cause of death globally and It has been estimated that about 1.27 million people died from antibiotic resistance in 2019¹
- ❖ The presence of these antibiotic residues in the environment has led to the proliferation and spread of these antibiotic-resistant bacteria²
- ❖ The major sources of antibiotics in water bodies are wastewater treatment plant (WWTP) effluents, untreated sewage and effluent of pharmaceutical industries
- ❖ Several methods have been employed for the removal of these antibiotics from wastewater, but adsorption has proven to be the most effective.
- ❖ Lignocellulosic materials have shown potential as an alternative low-cost material for the removal of antibiotics in water²



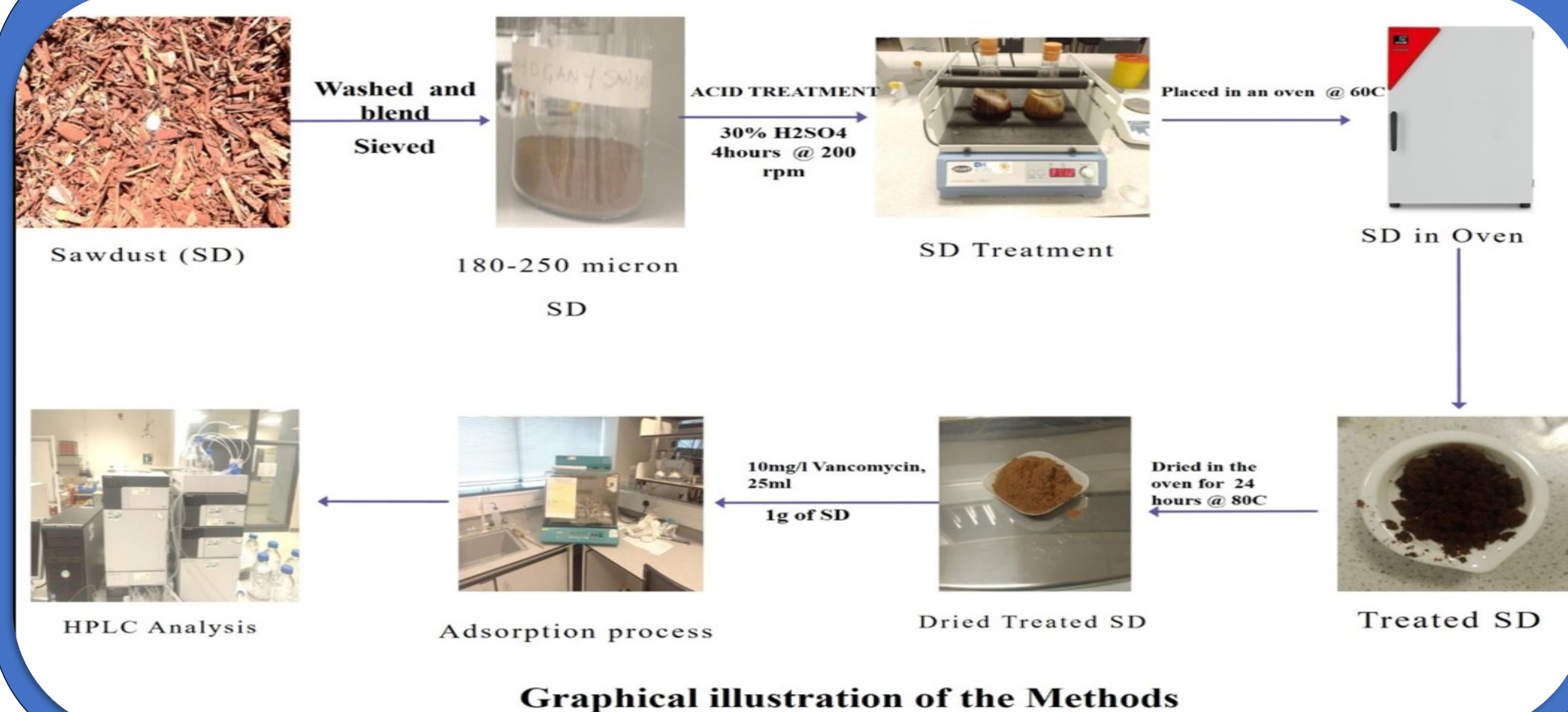
2. AIM AND OBJECTIVE

This study examined the use of Mahogany (*Swietenia mahagoni*) sawdust (MG) for the adsorption and removal of vancomycin from water. Vancomycin is an antibiotic which urgently requires an alternative as priority pathogens like *Enterococcus faecium* are becoming resistant¹.

The objective includes:

- ❖ Study the effect of chemical treatment on sawdust.
- ❖ Characterize the sawdust materials
- ❖ Study the effect of contact time, initial mass of adsorbent.

3. METHODOLOGY



4. RESULTS

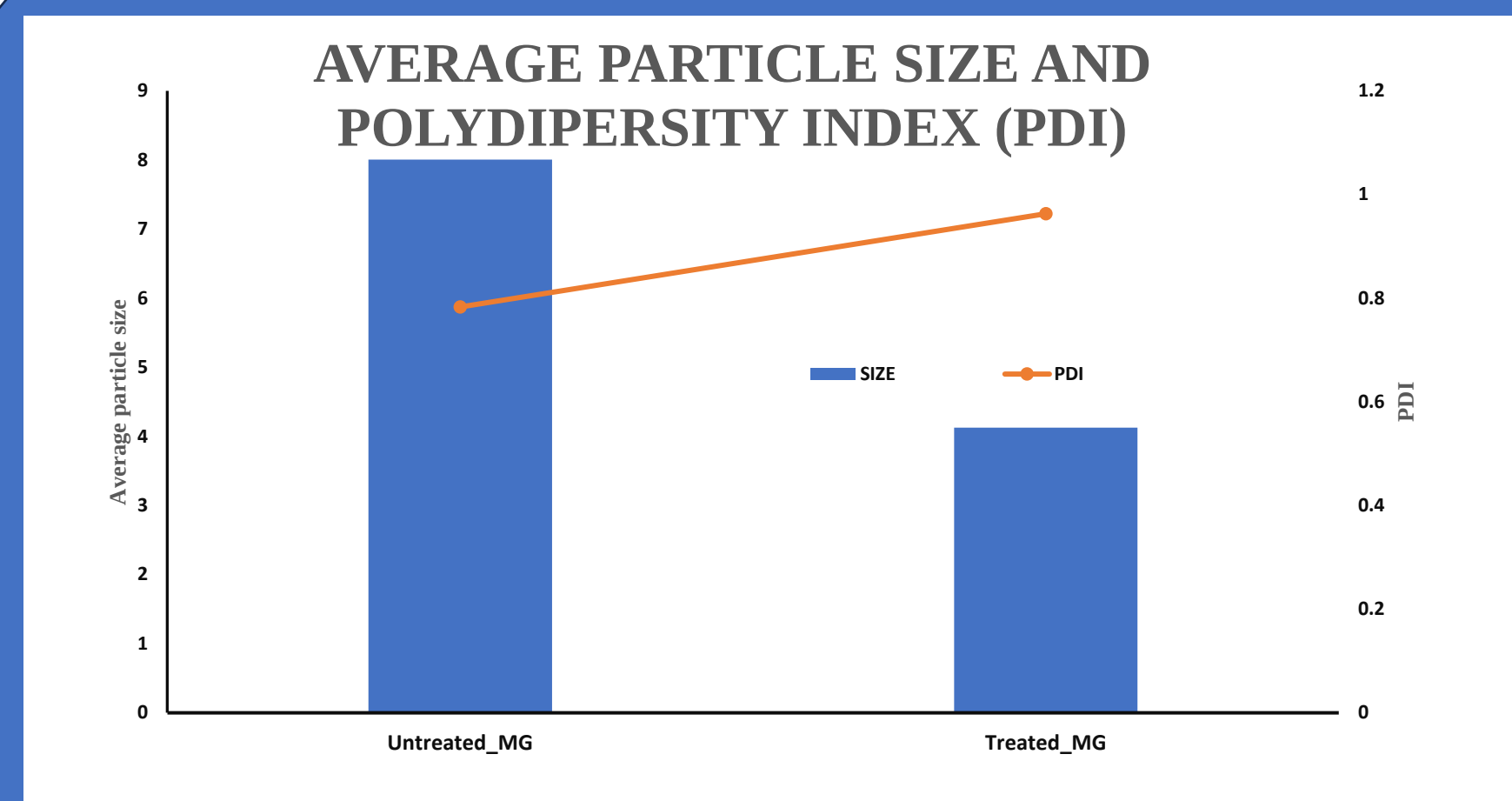


Figure 1: graph of Average particle size and PDI

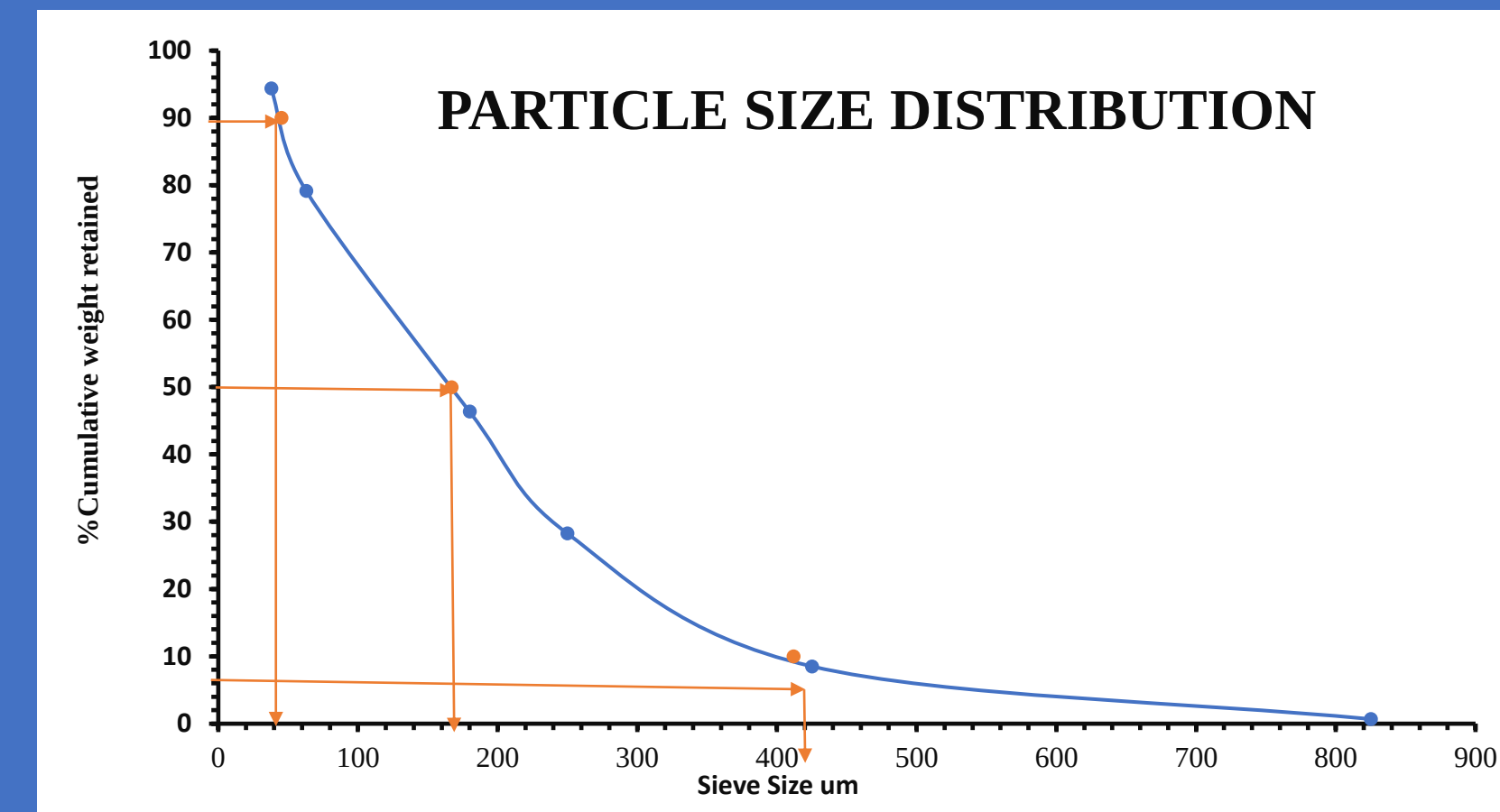


Figure 2: Graph of particle size distribution

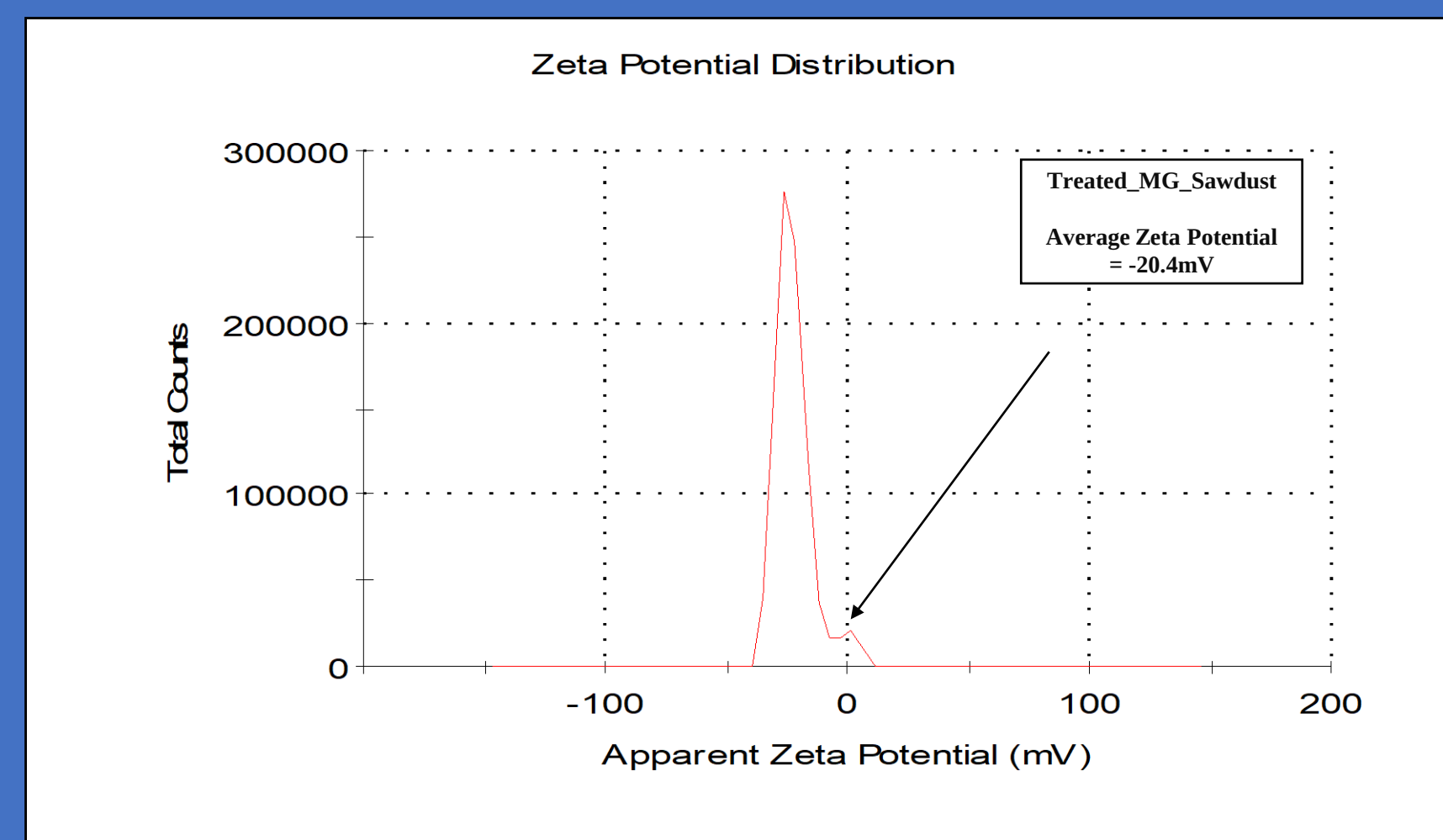


Figure 4: Zeta potential of the treated sawdust

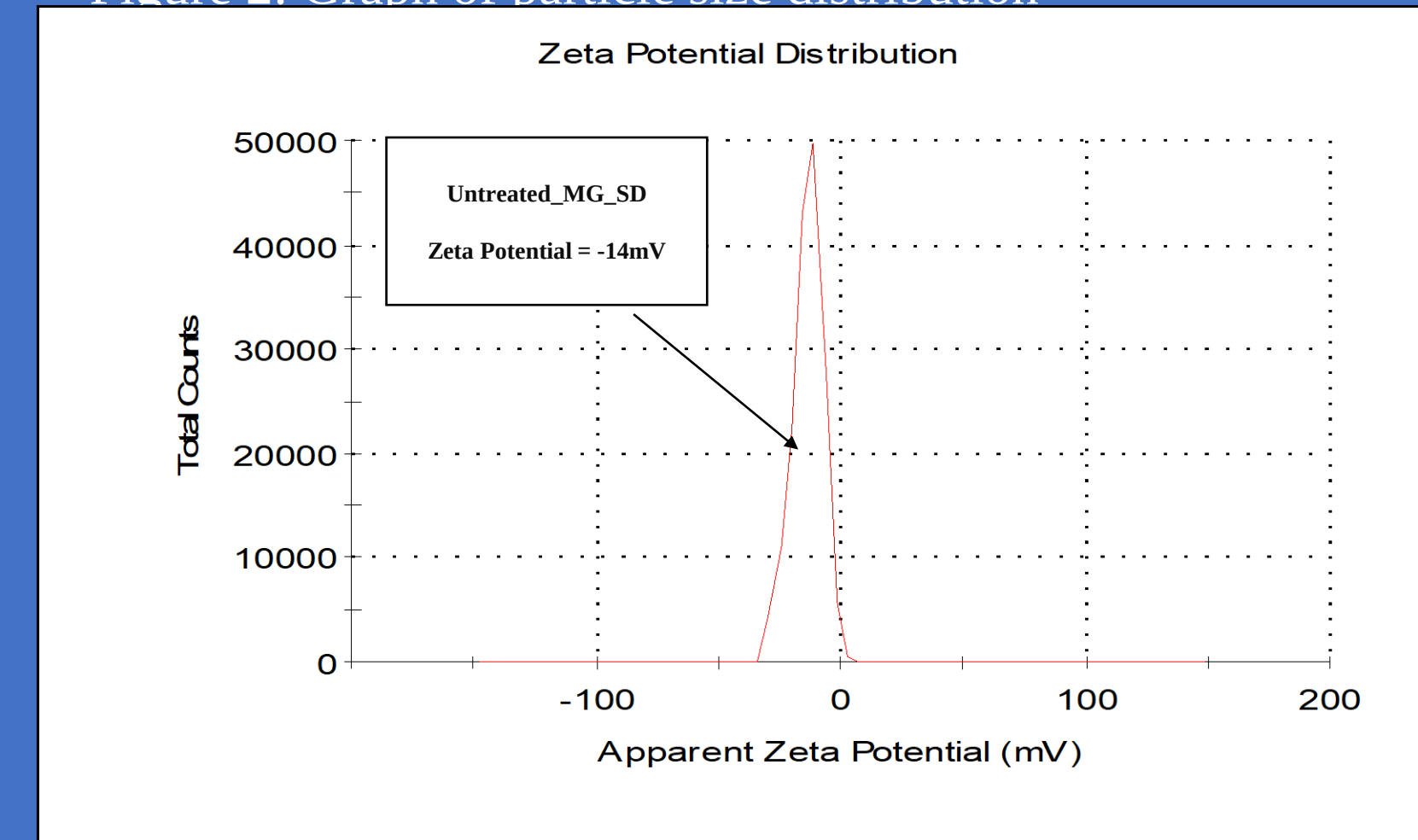


Figure 5: Zeta potential of the untreated sawdust

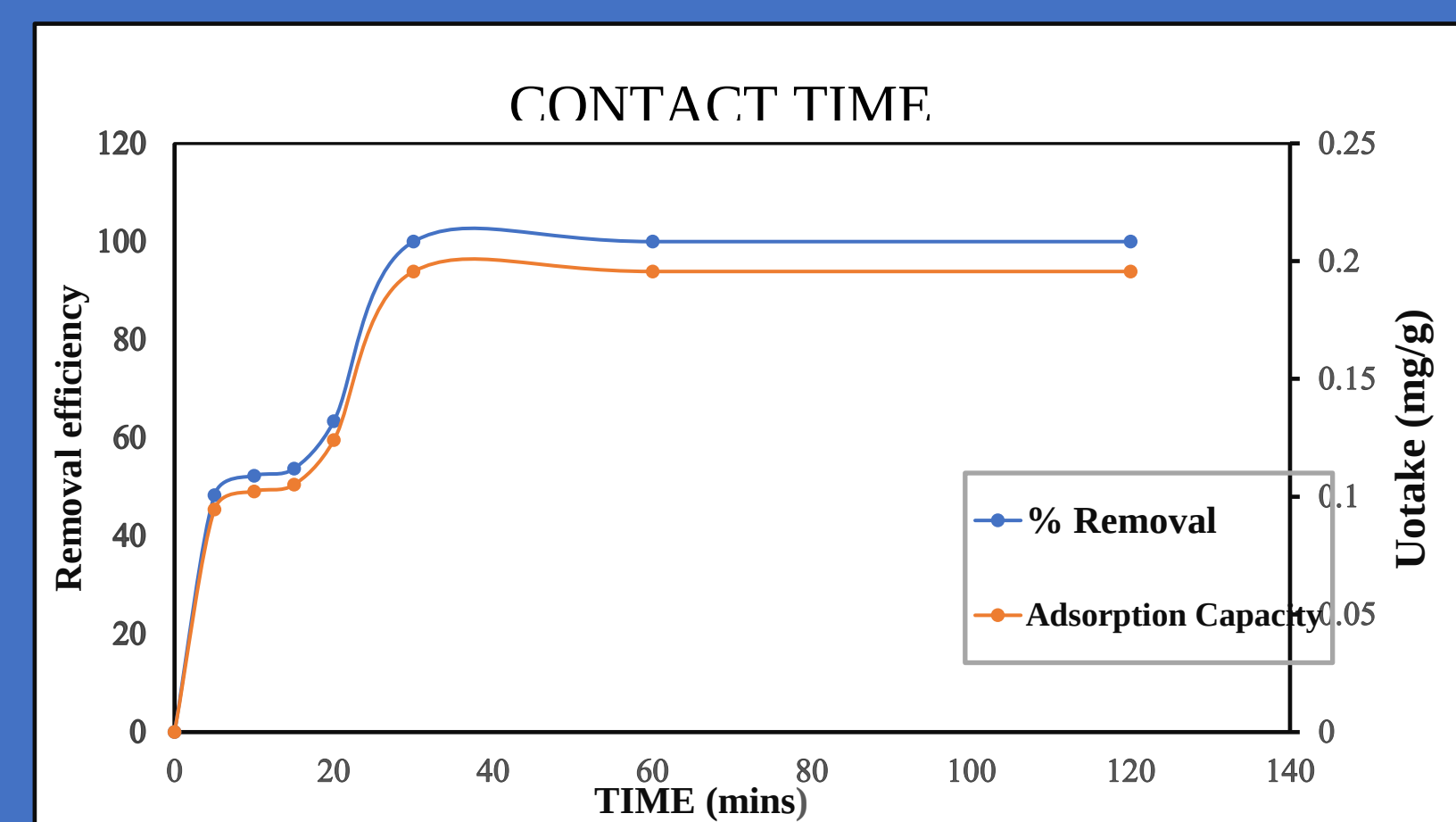


Figure 6: Time- dependent study for the untreated sawdust

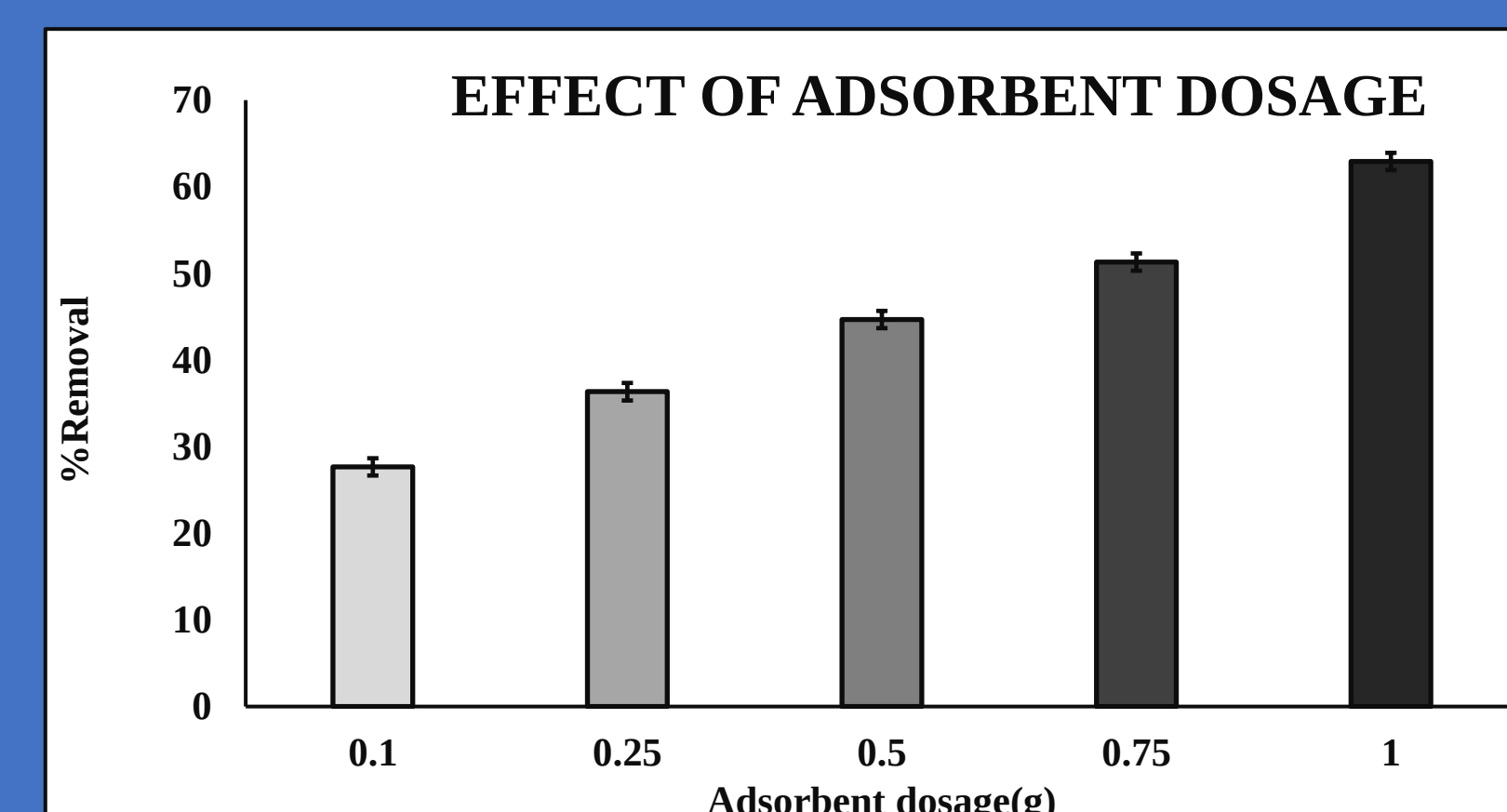


Figure 7: Adsorbent dosage study

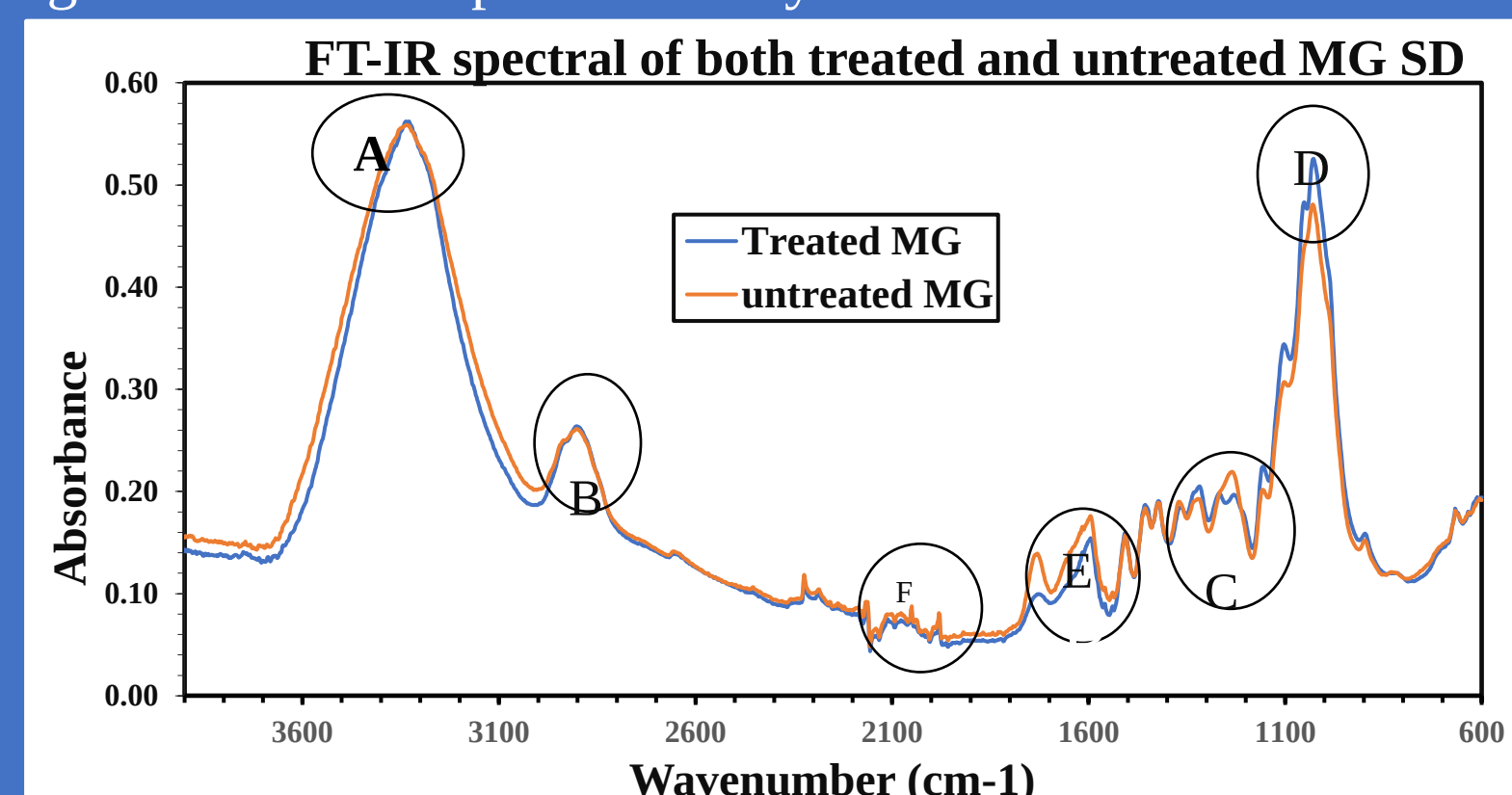


Figure 8: FTIR spectral of the sawdust

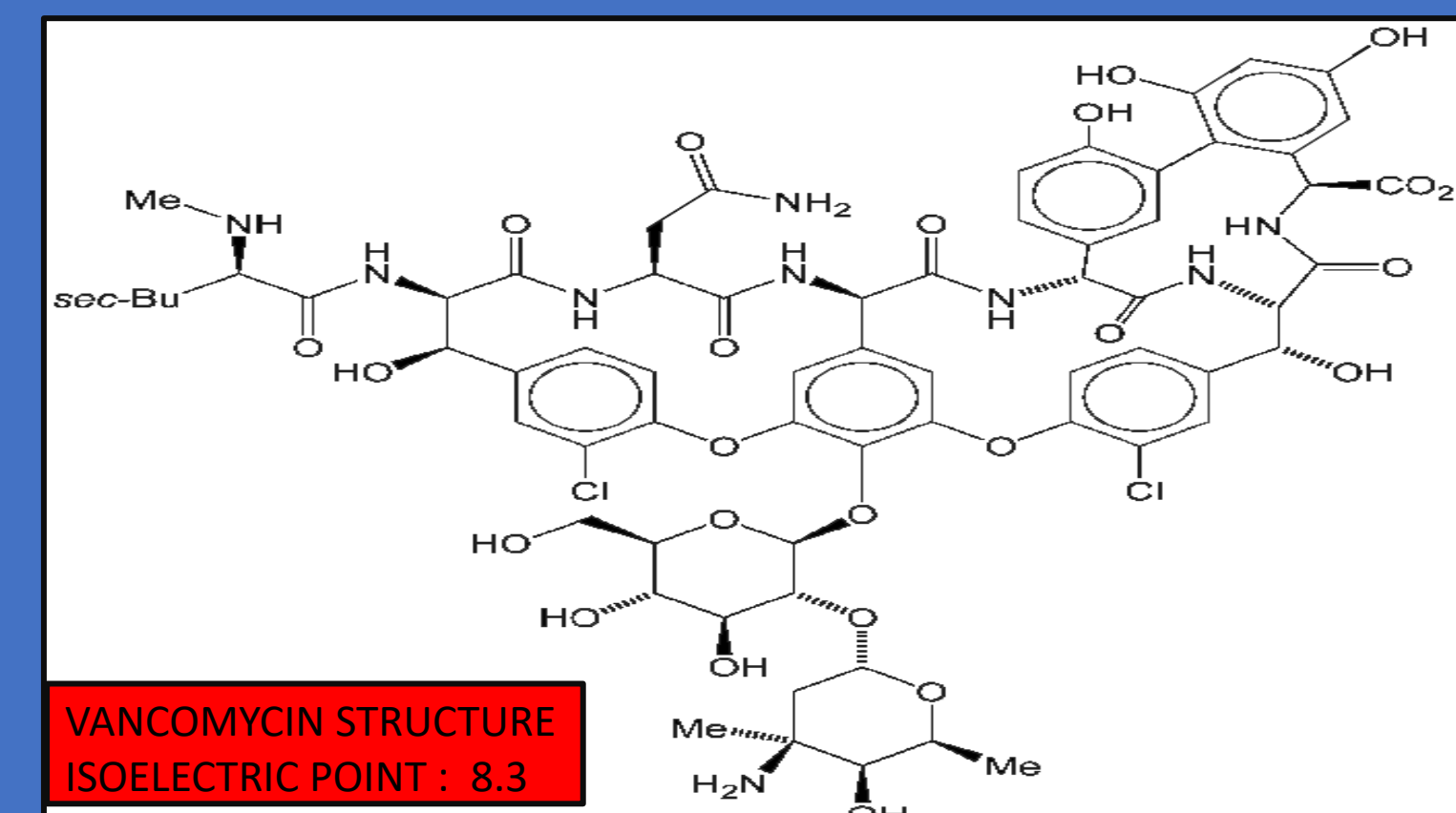
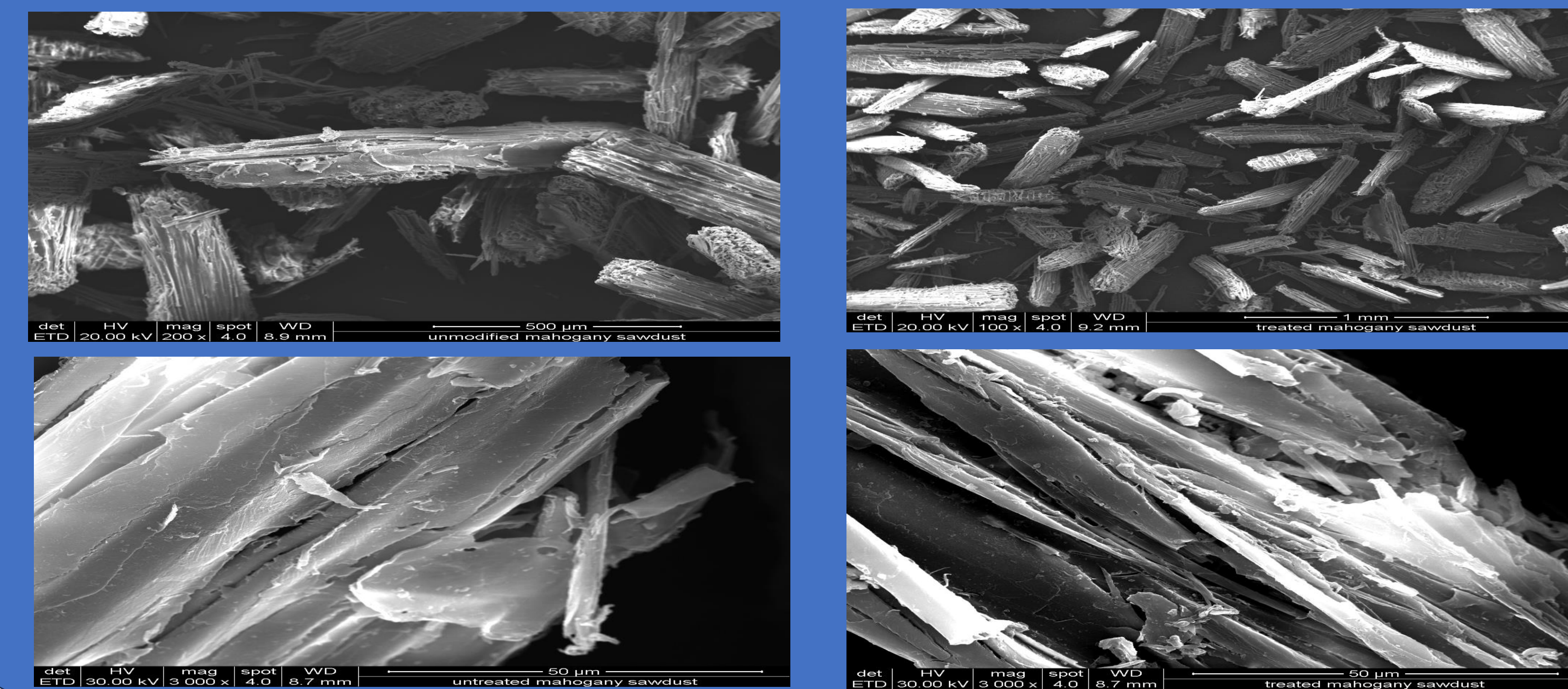


Figure 9: structure of vancomycin

RESULT : SEM ANALYSIS



5. DISCUSSION

- ❖ The results from Figure 1 show that there was a decrease in the average particle size of sawdust. This decrease is a result of chemical treatment while Figure 2 shows the particle size distribution, and this shows that the D₅₀ of the sawdust is around 167um.
- ❖ There is also an increase in the zeta potential of the treated sawdust, this is also a result of the acid treatment. Figure 6 also shows that over 40% of vancomycin had been removed and all the vancomycin had been removed within the first 30 minutes of the contact while the removal efficiency increased as the adsorbent dosage of the raw dust increased.
- ❖ The zeta potential shows that sawdust is negatively charged.
- ❖ Table below shows the functional groups present in the sawdust. From the structure of vancomycin, there is a possibility of ionic interaction between the amino group and the negatively charged active group of sawdust.
- ❖ The SEM image also shows that both the treated and the untreated sawdust has a rod-like shape.

Peak	Detailed explanation
A (3370-3310cm-1)	The broad peak indicate the presence of O-H group of aliphatic or aromatic group. The slight increase in absorbance and narrowing of the peak in the treated sawdust
B (2903cm-1)	This peak at indicate the presence of C-H stretching
C (1420cm-1)	The peak at point C are due to the methoxy vibration and this crystalline band of the sawdust.
D (1030cm-1)	The presence of shoulder peak at point D in the treated sawdust may indicate presence of SO2 Stretching
E (1730cm-1, 1590cm-1)	The band at point E are due to the vibration of C=C (1730cm-1) and C=O(1590cm-1) molecule present in the Lignin and hemicellulose molecule.

6 CONCLUSION

The acid treatment improved the size of the sawdust, and adsorption studies showed that the waste materials were adequate for vancomycin adsorption from water

Further studies will be conducted to determine the effect of pH, initial concentration, temperature, and other adsorption parameters on the materials and obtain the optimal condition before applying them to the environmental sample

7. REFERENCES

1. WHO, Global Priority List of Antibiotic-resistant bacteria to guide research, discovery and development of new antibiotics, 25th February, 2019.
2. 2. Akisanmi, Oluwashina, et al."Tackling Antimicrobial Resistance: Adsorption of meropenem and ciprofloxacin on lignocellulosic substrate from sawdust." European Waste Water Management Conference. 2019