The adsorption mechanism in the décolloration process was discussed in detail using the information obtained in the analysis of the adsorption process. In order to further investigate the effectiveness of the adsorption, the relationship between the adsorption capacity and the adsorption rate was considered. The influence of various factors on the adsorption process was also studied. The results showed that the adsorption capacity and adsorption rate were significantly affected by the type of adsorbent, the pH value of the solution, and the concentration of the dye. The optimal conditions for the adsorption process were determined to be pH 6.5, dye concentration 20 ppm, and temperature 30 °C. These conditions were used for the optimization of the adsorption process. The results showed that the adsorption capacity and adsorption rate were significantly increased under these conditions.

The Influence of Adsorbent Concentration on Adsorption Capacity

The influence of adsorbent concentration on the adsorption capacity was studied at different concentrations ranging from 0.1 to 1.0 g/L. The results showed that the adsorption capacity increased with increasing adsorbent concentration. The maximum adsorption capacity was observed at a concentration of 1.0 g/L. This is because at higher concentrations, more sites are available for adsorption, leading to higher adsorption capacity. However, at higher concentrations, the adsorption rate decreased due to the limited availability of sites for adsorption.

The Influence of pH Value on Adsorption Rate

The influence of pH value on the adsorption rate was studied at different pH values ranging from 4 to 8. The results showed that the adsorption rate increased with increasing pH value. The maximum adsorption rate was observed at pH 7. This is because at higher pH values, the positively charged dye molecules were attracted to the negatively charged adsorbent surface, leading to higher adsorption rate. However, at higher pH values, the adsorption capacity decreased due to the formation of negatively charged species in the solution.

The Influence of Temperature on Adsorption Efficiency

The influence of temperature on the adsorption efficiency was studied at different temperatures ranging from 20 to 40 °C. The results showed that the adsorption efficiency increased with increasing temperature. The maximum adsorption efficiency was observed at 30 °C. This is because at higher temperatures, the mobility of the dye molecules increased, leading to higher adsorption efficiency. However, at higher temperatures, the adsorption capacity decreased due to the desorption of dye molecules from the adsorbent surface.

The Influence of Contact Time on Adsorption Kinetics

The influence of contact time on the adsorption kinetics was studied at different contact times ranging from 1 to 24 hours. The results showed that the adsorption kinetics increased with increasing contact time. The maximum adsorption kinetics was observed at 12 hours. This is because at higher contact times, more dye molecules were available for adsorption, leading to higher adsorption kinetics. However, at higher contact times, the adsorption capacity decreased due to the limited availability of sites for adsorption.

In conclusion, the adsorption process was found to be highly influenced by various factors such as adsorbent concentration, pH value, temperature, and contact time. The optimal conditions for the adsorption process were determined to be pH 7, dye concentration 20 ppm, temperature 30 °C, and contact time 12 hours. These conditions were used for the optimization of the adsorption process. The results showed that the adsorption capacity and adsorption rate were significantly increased under these conditions. Further studies are required to investigate the long-term stability and regeneration of the adsorbent.
The adsorption efficiency was improved at higher temperatures (Figure 2). The adsorption capacity increased with the increase in the temperature from 20 to 50 °C. The increase in adsorption capacity is due to the higher chance of more adsorbate molecules reacting with the adsorbent surface. The maximum adsorption capacity was observed at 50 °C, which was 5.4 mg/g.

The effect of the pH value on the adsorption of MV by OPS was also studied. The results showed that the maximum adsorption capacity was observed at pH 2. The adsorption efficiency decreased with increasing pH values. The results indicated that the adsorption process is pH-sensitive and is influenced by the charge of the adsorbate and adsorbent. The adsorption capacity decreased with increasing pH values, which is due to the repulsion between the positively charged adsorbate and the negatively charged adsorbent.

The effect of the adsorbent dosage on the adsorption of MV was also studied. The results showed that the adsorption efficiency increased with the increase in the adsorbent dosage. The maximum adsorption capacity was observed at 1 g/L, which was 5.4 mg/g.

The results of this study suggested that OPS can be used as an effective adsorbent for the removal of MV from aqueous solutions. The adsorption process is pH-sensitive and is influenced by the charge of the adsorbate and adsorbent. The adsorption capacity decreases with increasing pH values. The adsorption efficiency increases with the increase in the adsorbent dosage.