

# Comparative Study of Powdered Activated Carbon and Granular Activated Carbon in Metaldehyde Adsorption: Unraveling Isotherm and Kinetic Insights

## Abstract

Slug pellets contain metaldehyde, a potent substance that kills molluscs, which also harms the environment and human health by polluting water systems. Metaldehyde removal from wastewater has emerged as a possible treatment strategy utilizing activated carbon materials such as powdered activated carbon (PAC) and granular activated carbon (GAC). This study aims to compare and analyze the adsorption mechanisms and kinetics of these materials. SEM studies of PAC and GAC revealed unique morphological characteristics, with PAC having a finely textured surface and a well-defined porosity structure, and GAC having a granular structure with irregularly shaped particles. According to the BET analysis, PAC had a larger surface area and pore volume than GAC, which had a lower surface area and pore volume. The FTIR spectra of PAC and GAC samples reveal different types of bonds such as  $\text{—OH}$ ,  $\text{O—H}$ ,  $\text{C—H}$ ,  $\text{C=O}$ ,  $\text{C=C}$ , and  $\text{C—O}$  which potentially affect their reactivity and interaction with metaldehyde. PAC performed better than GAC in removing metaldehyde from water, as it had a higher surface area and a wider range of pore sizes. The Langmuir isotherm and the pseudo-second-order kinetic model fit the experimental data well for this adsorption study.

## Keywords

Adsorption efficiency; Isotherm, Kinetics; Particle size; Water treatment