

## Development of novel low-cost quaternized adsorbent from palm oil agriculture waste for reactive dye removal

### ABSTRACT

An attempt was made to chemically modify palm kernel shell (MPKS) to increase adsorption affinity towards Reactive Black 5 (RB5). Granulated palm kernel shell (PKS) was quaternized successfully by treating with N-(3-chloro-2-hydroxypropyl)trimethylammonium chloride under alkaline conditions and was characterized. Surface characterization by Scanning Electron Microscopy (SEM) and BET analysis confirmed the surface pore enlargement from mesopores to macropores after modification. Fourier Transform-Infrared (FTIR) Spectrometer and CHN analysis revealed that the quaternary ammonia group (NR<sub>4</sub><sup>+</sup>) was successfully reacted on MPKS fiber. pH 4 is the optimum for removal of RB5 on MPKS. Equilibrium isotherms were analyzed by the Langmuir, Freundlich, and Redlich-Peterson models. The Redlich-Peterson model was found to fit well with the data. The maximum adsorption capacity of MPKS was 207.5 mg/g for adsorption of RB5.

**Keyword:** Characterization; Dyes; Isotherm; Low cost adsorbent; Palm kernel shell; Surface chemistry; Quaternization