

**REMOVAL OF CHLORPYRIFOS USING CARBOXYMETHYL  
CELLULOSE NANOCRYSTAL MEMBRANE:  
CHARACTERIZATION AND ADSORPTION STUDY**

**NORZAKIATUL HUSNA ISNOLAMRAN**

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This Final Year Project Reported entitled “**Removal of Chlorpyrifos Using Carboxymethyl Cellulose Nanocrystal Membrane: Characterization and Adsorption Study** ” was submitted by Norzakiatul Husna Isnolamran, in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Chemistry, in the Faculty of Applied Sciences, and was approved by

---

Ahmad Husaini Mohamed  
Supervisor

B. Sc. (Hons.) Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
72000 Kuala Pilah  
Negeri Sembilan

---

Nurul Huda Abdul Halim  
Project Coordinator  
B. Sc. (Hons.) Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
72000 Kuala Pilah  
Negeri Sembilan

---

Mazni Musa  
Head of Programme  
B. Sc. (Hons.) Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
72000 Kuala Pilah  
Negeri Sembilan

Date: 30 JANUARY 2019

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## ABSTRACT

### REMOVAL OF CHLORPYRIFOS USING CARBOXYMETHYL CELLULOSE NANOCRYSTAL MEMBRANE: CHARACTERIZATION AND ADSORPTION STUDY

The cellulose nanocrystals (CNCs) was successfully isolated from oil palm empty fruit bunch (OPEFB) using acid hydrolysis method. The CNCs obtained was functionalized into carboxymethyl cellulose nanocrystals (CMCNCs) through carboxymethylation technique using monochloroacetic acid (MCA) which undergo two steps process which were alkalization followed by etherification. Based on FTIR spectra, the decreasing in the intensity of peak around  $1320\text{ cm}^{-1}$  on CMCNCs spectra indicated the substitution of carboxyl group (COO) on the CNCs surface. The thermal stability of CNCs and CMCNCs powder were determined using thermogravimetric analyzer (TGA). The result shows the CMCNCs has higher thermal stability compared to CNCs as the functional group on the CNCs surface was modified. The prepared membrane than were compared by its capacity of absorption. The comparison observed that the capacity of water absorption was increased with the increasing of CNCs and CMCNCs dispersion in membrane. The adsorption study was done to identify the optimum membrane concentration to reduce the chlorpyrifos absorbance in its solvent by testing in 1 ppm concentration of chlorpyrifos. The absorbance of chlorpyrifos were determined using Ultraviolet-visible spectrometer (UV-Vis). The result of the adsorption study were show the degradation of the initial absorbance of chlorpyrifos peak at 230 nm by 1% CNCs membrane, 1%, 5%, 7%, and 9% CMCNCs membranes. This result shows the CMCNCs membrane has better removal ability compared to CNCs membrane. These finding validated this CNCs and CMCNCs membrane application was suitable for chlorpyrifos adsorption due to their promising and economically feasible technology.