



**Ecological Studies On The Red Swamp Crayfish**  
***Procambarus clarkii* at Fayoum Governorate, Egypt.**

**By**

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**Submitted to**

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**For fulfillment of the Ph.D. in Zoology (Ecology)**

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## Abstract

The red swamp crayfish *Procamparus clarkii* has rapidly expanded in all Egyptian freshwater ecosystem. So the aim of the present study is to collect crayfish samples from three different aquatic habitats at Fayoum governorate (Tanala, Elalam, and Elkaaby) to recognize its quality to fill the gap in protein resources and usage of its skeleton to prepare chitosan film in treatment of water copper toxicity. Water and crayfish amples were collected from the three studied different sites at Fayoum Governorate, Egypt. The results revealed highly significant differences in water quality of the studied sites of collections with high bioaccumulation of copper, zinc, lead and cadmium in crayfish muscles. Moreover, meat quality deteriorates according to pollution of the studied sites of collection (Tanala > Elalam > Elkaaby) with a decrease in protein and fat content, as well as the concentrations of calcium and phosphorous. Furthermore, chitosan polymer was extracted from crayfish exoskeleton with high-quality physical and chemical properties (less moisture content 0.3% and low ash percentage 0.2%). Usage of crayfish chitosan film (CFCF) efficiency towards copper ion was determined through laboratory experiments. The maximum removal was 88% at pH value 5, that increased (10% - 88%) with increasing contact time (30 - 360 minutes) until reaching equilibrium (300 - 400 minutes) where removal rate remains constant (the optimal contact time was 300 minutes). The efficiency is also affected by adsorbent dose (water copper concentrations), the removal of copper increase with increasing its concentrations until it reached maximum at (100 mg). Also CFCF efficiency decreased as the temperature increased. And the best temperature value for removing copper ions was 25°C, this extremely low temperature leads us to say that the adsorption process is physical. The thermodynamics and kinetics studies of the film performed, and the adsorption process is exothermic and the kinetic model pseudo-second order is fitted to CFCF film, which indicates that the adsorption process is a random process that is subject to nature. Adsorptive sites energy of CFCF was studied by applying two isothermal models; Langmuir and Freundlich models, it was found that Langmuir model is fitted to CFCF, meaning that the surface of the prepared film was homogenous.

One could have concluded that biological treatment of crayfish is mandatory by introducing a cheap food to fill the gap in animal protein, in addition to possible usage of crayfish exoskeleton in preparation of chitosan film to treat water copper toxicity.

**Keywords:** Crayfish, residual heavy metals, meat quality, Water copper remediation, Chitosan polymer.