

Adsorption of Remazol Brilliant Blue RR from Aqueous Solution with Calcined Ostrich Eggshells

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Extended Abstract

According to a UN survey worldwide, 80% of the wastewater generated enters the ecosystem without proper treatment [1]. All this even though many methods have been developed for water purification in recent decades and various technological developments and breakthrough results have been achieved. Scientific papers highlight a series of contaminants that can pollute the water systems, including dyes, heavy metals, pesticides, fungicides, pharmaceuticals, hormones, personal care products, phenol derived compounds, plastics, and other emerging contaminants that just recently were recognized as serious threats to human life and ecosystem.

Adsorption is proven to be an efficient method to eliminate pollutants from wastewaters even at low concentrations that range from ng/L to mg/L [2]. Its cost-effectiveness can be proven by the fact that the water treatment is estimated to cost for most remediation techniques 10 to 450 US\$/m³ treated water, while adsorption can cost 5-200 US\$/m³ [3]. The choice of the adsorbent, in turn, is key to the design and optimization of the adsorption process for water treatment.

In this study, calcined ostrich eggshell (COE) was investigated as a novel adsorbent for the removal of Remazol Brilliant Blue RR (RB) textile dye.

The effect of initial dye concentration was studied at ten initial dye concentrations (5-120 mg/L) for optimization. It was observed that the final concentration decreased to 0 at 5-30 mg/L concentration in 5-90 min. As the concentration increased, the removal time showed an increasing trend. For the effect of the initial mass (0.1-0.5-1-1.5-2-2.5-3 g COE and 5 mg/L RB), the final concentration after 210 min was 1.53 mg/L and the removal efficiency was 69.33% when 0.1 mg adsorbent was added. Variation of the chemistry (pH= 3-5-7-9-11) did not affect the removal rate, in all cases, an efficiency of 98% was achieved. We also investigated the effect of adsorbent, comparing the removal efficiency of COE and untreated ostrich eggs (OE) under the same quinine parameters. The COE removed the RB dye at a higher rate of 100% vs. 25%, and faster at 5 min vs. 360 min. Our results were also compared with our previous research on chicken eggshell experiments [4].

The characterization of the adsorbent material was executed with large-scale analytical measurements. FTIR and Raman spectra were used to detect the characteristic peaks of calcite and the functional groups typical of the dyes, respectively. In EDX, elemental analysis measurements showed a decrease in C and an increase in Ca for both dyes after adsorption, with S appearing in the sample, but N was only detected in the COE sample adsorbed with the blue dye. Lastly, SEM images showed that there is a significant structural and morphological difference between COE and OE.

References

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