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Adsorption and Electrochemical Regeneration for Industrial Wastewater Treatment

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Abstract : Graphite intercalation compound (GIC) has been demonstrated to be a useful, low capacity and rapid adsorbent for the removal of organic micropollutants from water. The high electrical conductivity and low capacity of the material lends itself to electrochemical regeneration. Following electrochemical regeneration, equilibrium loading under similar conditions is reported to exceed that achieved by the fresh adsorbent. This behavior is reported in terms of the regeneration efficiency being greater than 100%. In this work, surface analysis techniques are employed to investigate the material in three states: ‘Fresh’, ‘Loaded’ and ‘Regenerated’. ‘Fresh’ GIC is shown to exhibit a hydrogen and oxygen rich surface layer approximately 150 nm thick. ‘Loaded’ GIC shows a similar but slightly thicker surface layer (approximately 370 nm thick) and significant enhancement in the hydrogen and oxygen abundance extending beyond 600 nm from the surface. 'Regenerated’ GIC shows an oxygen rich layer, slightly thicker than the fresh case at approximately 220 nm while showing a very much lower hydrogen enrichment at the surface. Results demonstrate that while the electrochemical regeneration effectively removes the phenol model pollutant, it also oxidizes the exposed carbon surface. These results may have a significant impact on the estimation of adsorbent life.

Keywords : graphite, adsorbent, electrochemical, regeneration, phenol
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