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Plasma-etched electrospun nanofiber membrane as adsorbent for dye removal

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Highlights:

- A simple and green plasma treatment was used to fabricate PLLA fibrous adsorbents.
- The methylene blue dye was rapidly adsorbed on the plasma-etched nanofiber membrane.
- The adsorption kinetics follows the pseudo-second-order model.
- The isotherm data is well described by Langmuir model.
- The plasma-etched PLLA nanofiber membrane exhibited good reusability.

Abstract

The removal of hazardous dyes from wastewater is essential for environmental remediation. A simple, green and effective air plasma etching treatment was introduced to fabricate PLLA nanofibrous adsorbents. The cationic methylene blue (MB) dye could be rapidly adsorbed on the surface of plasma-etched PLLA nanofiber membrane through electrostatic interaction. It was attributed to the increased surface area and the generated binding sites after the plasma treatment. The adsorption behavior was influenced by both the plasma etching time and the initial MB concentration. It was found that the adsorption kinetics fits well with the pseudo-second order model, and the isotherm data fits well with the Langmuir model, revealing that monolayer MB was chemically adsorbed on the adsorbent. Moreover, the plasma-etched PLLA nanofiber membrane has also exhibited good reusability. It is believed that the plasma treatment may facilitate the design and fabrication of a new class of nanofibrous adsorbents.

Keywords: Electrospun Nanofiber, Adsorption, Plasma, Methylene blue, Membrane

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