

# Upcycling of Disposable Surgical Masks into Platinum Group Metal-free Electrocatalysts for Oxygen Reduction Reaction and Crude Oil

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Amid the pandemic of COVID-19, environmentally safe disposal of contaminated face masks has become a persistent challenge for the scientific community and this hazardous class of plastic waste is contributing further to environmental pollution. Meanwhile, pyrolysis is emerging as a promising methodology to upcycle the disposable face masks into valuable products, in order to minimize their environmental footprint. Herein, waste surgical masks were pyrolyzed under controlled conditions to produce carbonaceous char and crude oil. The obtained char was chemically activated with KOH followed by functionalization through iron phthalocyanine, to prepare catalysts for oxygen reduction reaction (ORR). The functionalization allowed the formation of Fe-N-C active sites on the carbon backbone. The electrocatalysts synthesized were analyzed in neutral and alkaline conditions for ORR by using a rotating ring disk electrode (RRDE) in oxygen saturated electrolyte. The functionalization with iron improved the electrocatalytic activity compared to the bare char and activated char. The higher electrocatalytic activity was also measured in alkaline media compared to neutral media. However, high overpotentials were measured indicating that the synthesis process could be improved. Additionally, samples of crude oil produced during the pyrolysis were collected at different temperatures of 500°C, 700°C, and 900°C, and were deeply analyzed using state-of-the-art characterization techniques. This work positively highlights the possibility of transforming waste surgical masks into valuable electrocatalysts within the core of the circular economy.