Fabric Wastes: A valuable feedstock for wastewater pollutant adsorbent and magnetic mesoporous activated carbon precursor

Jenny Sayaka Komatsu, Beatriz Mianni Motta, Dalmo Mandelli, Wagner Alves Carvalho, Universidade Federal do ABC, Santo André, BR - Pol Willy Gerard de Pape, Rigaku Latin America, São Paulo, BR

Abstract (300 word limit)

Nowadays, great focus is given to study the use of agro-industrial waste as feedstock for chemical transformations, neglecting the potential of municipal solid wastes (MSW). Among them, textile fabric waste is increasing worldwide, with more than 38 million ton being sent to landfill or incinerated in a year [1] with very restricted recycling market.

Cotton, polyester, polyester/cotton and polyester/elastane fibber fabrics were applied as dye adsorbent and subsequently pyrolyzed to produce magnetic activated carbon (MAC).

First, Iron Nitrate was impregnated in the various fabrics, and applied in adsorption of a 100mL, 50 mg L^{-1} starting reactive black dye solution to 1 g adsorbant. White cotton showed a high adsorption capacity of 35 mg_{Dye} $g_{Adsorbant}^{-1}$, in less than 30 min contact. Polyester/elastane fabric showed the best colour removal (99.45%), while the polyester/cotton mixture showed the worst result (28.72%). Total Organic Carbon content confirmed that there was no chemical degradation of the dye, which would lead to a more toxic and dangerous compound int the environment.

All carbons produced under nitrogen atmosphere at 700 °C for 2h, developed both micropores and mesopores up to 5 nm, with an average 428 m^2 g^{-1} BET area, and showed magnetic property with a magnetization saturation up to 47.5 emu g^{-1}. Magnetism is a hot topic in the development of new materials [2] for use in adsorption and heterogeneous catalysis due to its easy to recover property.

Conclusion & Significance: This proposal gives important insights for two major environmental issues in the fashion industry: solid fabric wastes and dyeing wastewater. Fabric when combined with iron nitrate, enhances its adsorption capacity and lead to a mesoporous MAC. Social impact is relevant in countries like Brazil. Including the fabrics as a "recyclable" item, it will increase the income of recycling agents, decrease MSW collection costs and extend landfill lifetime.

Recent Publications (minimum 5)

Komatsu J S, Mandelli D and Carvalho W A. Mesoporous Magnetic Activated Carbon (M^2AC) from Cotton Textile after application as adsorbent – Characterization. Proceedings of 20th Brazilian Congress of Catalysis. Sep 2019

Komatsu J S, Mandelli D and Carvalho W A. Valorization of Textile Residue, as Dye Adsorbent and Sequential Production of Magnetic Activated Carbon (MAC). Proceedings of 1st Brazilian Symposium on Sustainable Chemistry. Oct 2018

Komatsu J S, Mandelli D and Carvalho W A. A Novel Process of Dye Adsorption by Textile Residues and Posterior Pyrolysis to Produce Magnetic Activated Carbon. Proceedings of 7th Brazilian Carbon Congress. Oct 2017

Komatsu J S, de Pape P W G, Mandelli D and Carvalho W A. Iron Nitrate as Chemical Activator Agent for activated carbon production, from cotton fabric, and application study as textile dye adsorbent. Proceedings of 9th Mercosur Catalysis Congress. Sep 2017

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[2] Wiley Online Library. Hot Topics in chemistry and materials. Available at https://onlinelibrary.wiley.com/doi/toc/10.1002/(ISSN)1616-3028.hottopic-magneticmaterials, accessed on 10th Oct 2019



Biography (150 word limit)

Jenny Sayaka Komatsu is a PhD student in the Chemical Science and Technology Department, Sustainable Technologies Nucleus at Universidade Federal do ABC, Brazil. She has a MSc from Kyoto university in the Urban Environment Engineer Field and graduated in Chemical Engineer at Universidade de São Paulo, Brazil. She worked in private sector for nine years, and is a technical expert on green house gas, carbon credit projects on the UNFCCC framework and also voluntary markets, in industry, energy and forest sector. She also has high knowledges on municipal solid waste treatment technologies.

Email: jenny.k@ufabc.edu.br

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