UTILIZATION SORBENT ON LIGNOCELLULOSE MATERIALS BASE FOR REMOVES HALOGENATED DYES INCREASING PARAMETER AOX FROM MODEL EFFLUENT WATER

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Abstract
Dyes are a class of organic most visible pollutants. In the current study, the structural and adsorptive properties of the oxycellulose and cultivated flax as well as the possibility to use them as adsorbents for removal of reactive dyes Procion Blue H-5R, Reactive Blue 4 and Reactive Red 120 from aqueous solutions have been investigated. Determining the amount of dye removed from the solution is performed by spectroscopy prepared solutions of model dye.

Introduction
Dyes
Removal of textile dyes from wastewater constitutes an important topic of study for environmental protection specialists, considering the impact of these pollutants on the waters where they are discharged[1]. Thus, the presence of dyes in surface waters leads to problems related to aesthetics, inhibition of aquatic flora and fauna development, occurrence of different by-products with carcinogenic effect formed by dyes degradation[1]. Different techniques have been developed and applied for treatment of textile wastewater, which is characterized by colour, high values of pH, considerable amounts of suspended solids, different and unacceptable COD levels, and the presence of non-biodegradable chemical compounds[2-5]. Physical methods, such as mechanic separation (coagulation, flocculation, precipitation) or membrane processes, physic-chemical processes (adsorption, chemical precipitation, coagulation-flocculation, and ionic exchange), chemical process (advanced oxidation with ozone, H_2O_2, UV), biological process (biological processes in connection with the activated sludge processes and membrane bioreactors) or combination of those can be applied in order to ensure the efficiency of dye containing wastewater treatment process[2, 5-17]. Adsorption remains one of the techniques that have been successfully applied for dyes removal[1, 8]. This is the result of the fact that adsorption is an easy and feasible technology that can use a variety of materials as adsorbents.
Oxycellulose and cellulose are carbohydrate polymer consisting of β-D-glucose repeating units is considered the most abundant renewable polymer resource available on Earth[1]. Depending on the technological process used to produce them, celluloses may be found in many forms and types ranging from fibres, linters, microcrystalline powders, softwood pulp, bacterial cellulose and many others.

Dyes were selected for experimental studies.

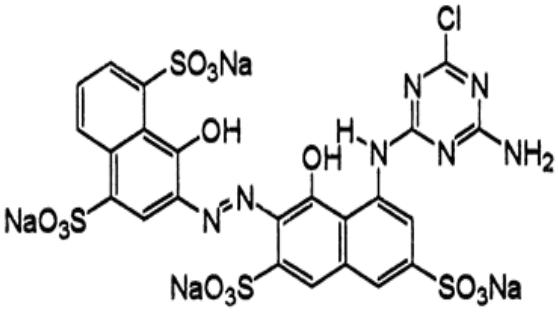

Figure 1. Procion Blue H-5R (PB H5R), Alfa-Aesar Co., dye content 100 wt. %

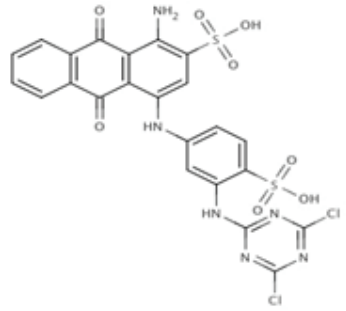

Figure 2. Reactive Blue 4 (RB4), Sigma-Aldrich Co., dye content 35 wt. %, A_{max}= 595 nm

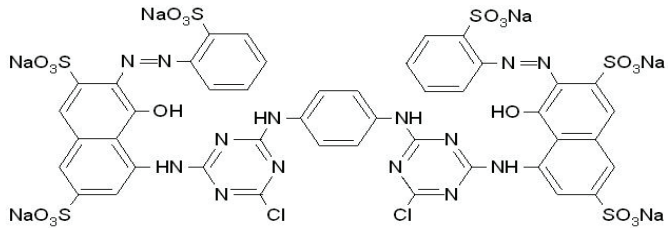

Figure 3. Reactive Red 120

Table I
Specification of dyes

Colours	c [mol l^{-1}]	m [g]
Procion Blue H-5R	0.01	4.33
Reactive Blue 4	0.01	7.97
Reactive Red 120	0.01	7.35

Experiment

A stock solution of 0,01mol/l was prepared by dissolving the appropriate amount of dyes in 100ml and completing to 1000ml with distilled water. Calibration was performed in a set of 50-ml graduated flasks with various initial concentrations ($6.47x10^{-7}$- $3.85x10^{-5}$). For equilibrium studies, the experiment was carried out for 90min to ensure equilibrium was reached. The adsorption experiments were performed through batch method by contacting different amounts of adsorbent with 250 ml of solution containing 10ml of dye.

Preparation of materials for experiment

Wood chips were milled a special laboratory mill for 30 seconds. Cultivated flax was cutting first into short fibres (0.5 cm). Stems were sorted on the sorting sieves with a mesh size of 5 mm and 3.5 mm. oxycellulose were also cut into small pieces of 0.5 × 0.5 cm.

Work

The batch device used for the model wastewater treatment consisted of electromagnetic stirrer with equipped heating. The chemisorption process was carried out applying rapid agitation at 90°C of alkaline reaction suspension or solution for complete nucleophilic substitution of chlorine in chlorotriazine reactive group or nucleophilic addition on vinylsulfone reactive group. The pH was adjusted using 10.6 g/l Na_2CO_3. After the nucleophilic reaction followed by neutralization or acidifying of the reaction mixture, the used sorbent was removed by subsequent filtration and dye concentration of treated wastewater was determined using absorbance determination.

The batch device used for the model wastewater treatment consisted of electromagnetic stirrer with equipped heating. The pH was adjusted using altered by a 50% NaOH aq solution to 12 - 12.5.

The mixture was intensively stirred for 2 hours at the temperature of 90 or 25^{0}C. After a period of 2 hours, the pH was adjusted using 16% H_2SO_4 on value 1-2. The mixture was filtered through filter-paper. The dye concentrations in filtrates were determined using spectrophotometry[18].

Results analysis

The effects of sorbent type of (PB H5R) dye were presented in Figures 4-6.

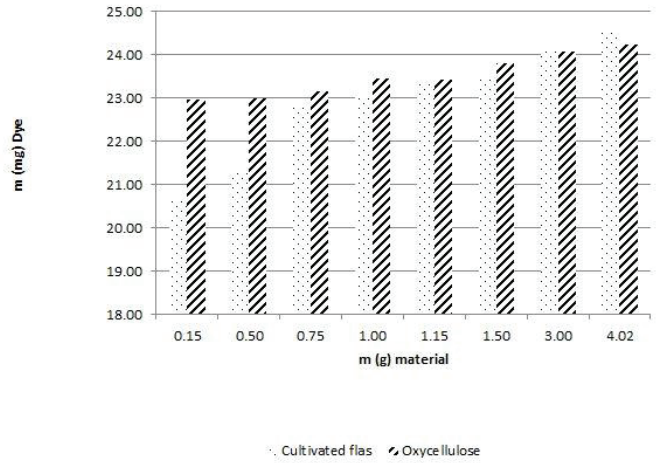

Figure 4. Procion Blue H-5R 25^{o}C

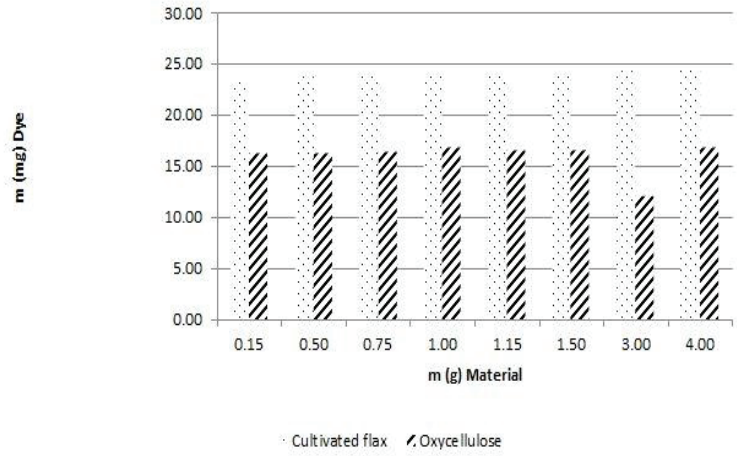

Figure 5. Reactive Blue 4, 90^{o}C

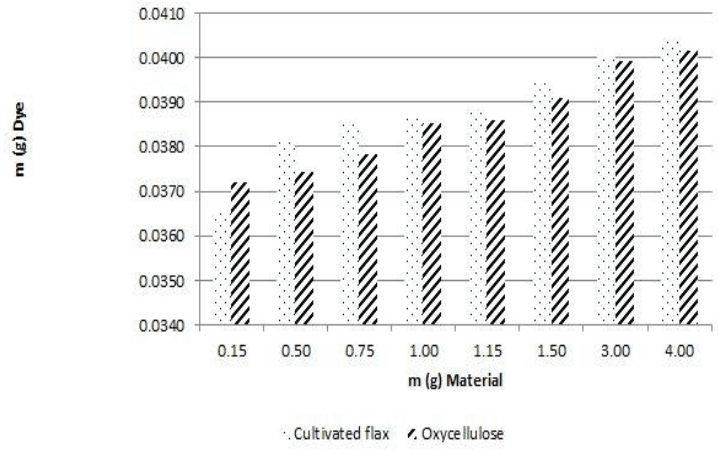

Figure 6. Reactive Red 120, 25^{o}C

Of the results obtained is apparent that adsorption capacity of the investigated materials for removal of dyes from aqueous environment strongly depends on the structure of dyes and the working conditions
Adsorption at room temperature was more efficient method for removing the reactive dyes from waste water before the removal of selected organic dyes by heat treatment.
Use of stems of annual plants better than the use of wood chips and sawdust from trees because they contain accompanying substances (mainly tannins and pigments extractable by water) that affect the reactivity and subsequent evaluation.
Oxycellulose were decomposed, gelling adsorbent material.
Further research regarding the study of adsorption equilibrium is encouraged in order to gain useful information.
It was observed that the optimum values of experimental parameters and the maximum amount of dye adsorbed onto oxycellulose were dependent on the type of dye.

Conclusion

Different biomass based materials was tested for simple removal of dyes. Biomaterials were indicated as the most effective bio sorbent for the sorption of dye. For comparison, effect of temperature for the decolourization yield was compared and as could be seen surprisingly, slightly better yield at room temperature rather than reaction conditions suitable for reactive dyeing (temperature 90^0C).

Acknowledgement

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