Column Techniques for Treatment of Textile SMEs' Effluents

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INTRODUCTION

Like any other industrial effluent textile wastewater holds certain particularities in the presence of contaminants, which distinguishes both treatment of such effluents and removal of harmful auxiliaries and aiding agents used in textile preparation, production and finishing processes. Long lists of additives, labeled as impurities to be removed after completion of production processes, starts with textile dyes, which used even in low concentrations produce undesirable brightly colored effluents. Acids and alkali are imperatively neutralized, thus avoiding elevation of pH levels in receiving waters or aquifers. Specific operations like reactive dyeing may require employment of large quantities of salts (usually sodium chloride and sodium sulphate), which may cause elevation of electrolyte level in effluents. Detergents and other surfactants may cause eutrophication, thus like all here listed auxiliaries demanding removal from effluents prior to release. Treatment methods are mandatory in order of achieving proper level of legislatively demanded effluent purity.

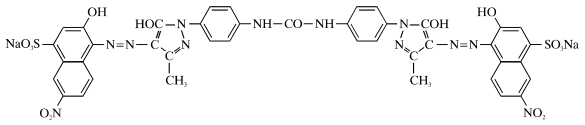
In this paper a rather inexpensive treatment method of biosorption is described along with the construction of model column. Described treatment process belongs to a group of column techniques in which layers of adsorbents are arranged on top of each other forming a vertical treatment medium. Adsorbents were used based on their accessibility in the region and price, regarding the end result of facilitation of a real scale pilot project. Pilot project would be appropriate treatment solution of effluent waste wasters for textile based SMEs as well as for domestic households.

METHODS

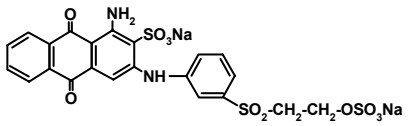
Model effluents

Model dyehouse effluents were prepared as two separate solutions of dyestuff: diazo Direct Red 173 and vinysulphonic Reactive Blue 19 of different chemical constitutions. Concentration was set to 1 g/l of, which can be considered to be expected amount of dye remaining in the effluent after the dyeing process. Auxiliaries/aiding agents were added to both investigated solutions, as follows: cationic surfactant hexadecylpyridinium chloride monohydrate in the concentration of 0,5 g/l and sodium chloride in the concentration of 10 g/l.

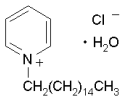
Chemical constitutions of dyes and aiding agents is shown below.



Direct Red 173



Reactive Blue 19



Cationic surfactant

NaCl

Sodium chloride p.a.

Vertical column

Laboratory model was designed as a vertical column, 19 cm in height, 14 cm in diameter and 3967,39 cm^3 of volume, with an outlet valve at the bottom of the column. Adsorbents were selected based on accessibility in the region of northern Croatia according to the profiles of soil found at two investigated locations. Based on this data, two models of vertical columns were arranged using layers

of sampled soil forming a medium for treatment of modeled effluents. Information on soil layers particle size is, as follows: fine sand (grain size 0,5-1 mm), sand (grain size 1-4 mm), gravel (grain size 8-16 mm) and coarse gravel (grain size 32-64 mm). As an addition to one of the columns, sawdust (particle size 150 μm) was added in order of increasing absorption and investigating it's treatment properties (column 2). Geotextile filter: PP (surface mass 500 g/m^2, thickness (20 N) 3,70 mm), has been used as a last filter component, placed at the bottom of the column. Retention time of modeled effluents was set indirectly by setting the flow to 5 l/min.

Measurements

Performance of investigated treatment methods was evaluated over following parameters: Special Absorbance Coefficient (SAC), ISO 7887; Electrical conductivity and Biochemical Oxygen Demand (BOD_5), EN 1899-2. Reduction efficiency of all introduced contaminants can be calculated accordingly:

Reduction efficiency (%) = ((Initial value – Value obtained after treatment) / Initial value) · 100

RESULTS AND DISCUSSION

Efficiency of investigated column techniques and behavior of introduced contaminants under proposed treatment method was evaluated through direct parameters. Presence of sawdust in the treatment column significantly intensifies reduction efficiency of all introduced contaminants. Proposed treatment methods showed higher discoloration efficiency in the case of direct azo dyestuff, although reactive effluent of significantly lower discoloration showed higher absorptivity of sodium chloride (decrease in electrical conductivity) and cationic surfactant (decrease in BOD_5 value).

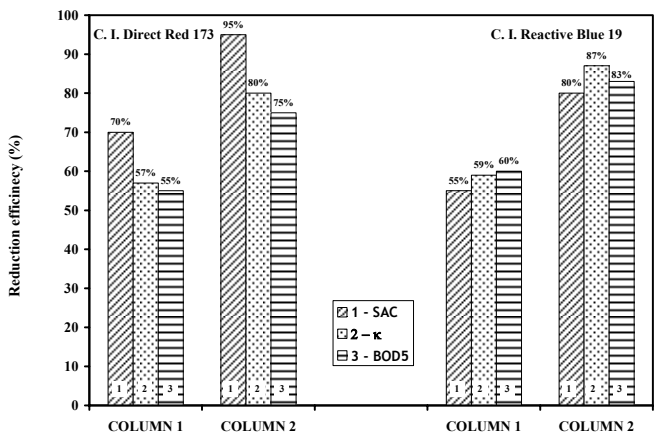


Fig. 1. Reduction efficiency of introduced contaminants

CONCLUSIONS

According to the obtained results, addition of large surface area adsorbent like sawdust is necessary in order of increasing contaminant reduction.

Information obtained from investigation of modeled techniques can be used as a reference for construction of real scale pilot project appropriate for treatment of textile effluents of SMEs and domestic households.

REFERENCES

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