"ElectroChemical techniques combined with UV irradiation for the treatment and reuse of textile dyeing wastewater"

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Introduction:

Textile industry generates high amounts of water in their dyeing and finishing processes. The problem arises in the treatment of wastewaters which contains dyes due to their not biodegradable character. Nowadays, depuration of this kind of effluents requires additional treatments before their discharge to a biological plant or after the biological treatment. The most common processes imply physical methods based on the pollutants separation (i.e. flocculation-coagulation, activated carbon and resins); therefore, two products are obtained: a concentrated waste and the clean water. Consequently, this concentrated waste also needs to be treated in order to degrade the non-biological components.

The electrochemical treatment can solve the problem of concentrated wastes, their further tertiary treatments and it can save important amounts of water due to the reuse process. This technique is based on dyes degradation by a direct decolouration in the same dyeing bath, which also avoids residues generation and chemicals additions. The salts already contained in the dyeing bath are used as electrolyte to carry out the electrochemical treatment. A subsequent step based on the reuse of the treated effluent will save an important amount of water and electrolyte.

In order to enhance dyes decolouration and to prevent chlorine-compounds generation (secondary products produced as combination of electrochemistry and chloride) a UV lamp is placed into the electrochemical cell.

These two treatments have never been used before in wastewater treatments from mills.

Results:

The ECUVal method (treatment and reuse steps) achieves promising results summarized in the following table:

Effluent treated	New dyeing	Water saving	Salt saving	Colour difference with respect to a reference dyeing
Exhausted bath	Monochromie	70%	60%	$DE_{CMC(2:1)}$ <1 → acceptable results.
Exhausted bath	Trichromie	70%	60%	$DE_{CMC(2:1)}$ >1 → It can only be accepted in some special cases, i.e. zippers or shoelaces, where the acceptance limit can be 1.5 or even 2.
First washing	Monochromie	100%	15%	$DE_{CMC(2:1)}$ <1 → acceptable results.

First washing	Trichromie	100%	15%	$DE_{CMC(2:1)}$ <1 → acceptable results.

* $DE_{CMC(2:1)} \leq 1$ is the acceptance limit for the industry.

Therefore, ECUVal system is based on the degradation of reactive dyes contained in the effluents from textile dyeing and washing by means of an electrochemical cell combined with ultraviolet radiation. The value of ECUVal lies in the removal of residual dyes without the addition of chemical reagents. The new system uses the salts present in these effluents as electrolytes, and also it does not generate other waste requiring further treatment. Therefore, after the ECUVal treatment, the uncoloured wastewater, which contains a certain amount of salt, can be reused in a new dyeing process.

In addition, ECUVal covers other objectives: to manufacture an industrial plant in order to demonstrate the feasibility of the technology, to scale up the ECUVal system at commercial level and to optimize the conditions of the treatment applied to effluents of finishing textile industry (dyeing processes) and finally, to create a sustainable business model based on an innovative process for the treatment of effluents.

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