DOI: http://doi.org/10.21698/simi.2019.fp14

TREATMENT OF HEMP RETTING WASTEWATERS: USE OF BY-PRODUCTS FROM WINEMAKING INDUSTRY

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Abstract
The present study considered the use of a by-product from winemaking for the treatment of wastewater from hemp retting process.
To evaluate if different obtained extracts of grape marc (BRE-extract of refrigerated grape marc, BUE-extract of dried grape marc, BLE-extracted of lyophilised grape marc, BLM-ultrasound soaked lyophilised grape marc, BLM fUS-soaked lyophilised grape marc, no ultrasound treatment) are feasible to be used for the wastewater treatment.
The chosen parameters (pH, turbidity, dissolved oxygen and conductivity) were monitored over 14 days and it was observed that starting with day 8 the measured values for all parameters remained constant.

Keywords*: grape pomace extracts, hemp retting wastewater, monitored quality parameters*

Introduction

Textiles remained of great interest since very old times till nowadays (Paret et al. 2019). The textile industry is also responsible for the high amount of used water, while the resulting wastewaters could raise environmental problems due to their high chemicals concentration.
Recently, the attention for natural fibres was revived and the market is focusing on apparel based on cotton and bast fibres.
Hemp is one of the most known and exploited sources of raw material, especially for the textile industry, due to its good mechanical characteristics.
Unfortunately, the extraction hemp fibres have also a negative impact on the environment, mainly due to the retting process that takes large amounts of water and energy, and because of the biochemical fermentation processes, the resulting water has a high level of organic compounds (Li 2009).
In general, the reusing the wastewater is not possible because of the missing aeration process after water-retting of hemp. Besides the oxygen depletion during the hemp retting process, an unpleasant smell is affecting the environment due to the formation of unstable fatty acids and butyric acid.
Independent of the methods used to obtain the hemp fibres, these processes need to be designed by the environmental protection principles (Werf & Turunen 2008),

while the possibility of applying circular economy directions should also be considered.

Today, for the wastewater treatments is used a large range of advanced methods that are based on the oxidation reaction in the presence of O_3, ultraviolet radiation, hydrogen peroxide or emerged technologies (Kortekaas 1998). Each developed method aims to improve the final parameters of the water that will be discharged into the environment (Bajpai 2017).

The parameters that are usually monitored for the evaluation of the wastewater characteristics are pH, chemical oxygen demand, total residual chlorine, dissolved oxygen, biochemical oxygen demand, and phenolic compounds (Kumar 2017).

The present study has in attention a new method for the treatment of wastewater from the hemp retting process that is based on the valorisation of winemaking waste, namely grape marc.

In our opinion, this attempt contributes to the reduction of the agro-food waste, as this type of waste remains under-used in Europe, in particular at small producers, despite numerous potential advantages and proven antioxidant, antibacterial and antifungal properties of many by-products (Beres et al. 2017). Moreover, the grape marc was used for the treatment of wastewater resulted from hemp plants retting process.

Materials and Methods

Materials

White grape marc provided by ICDVV Valea Calugareasca, Romania.

Reagents

Ethanol absolute (Sigma-Aldrich, Germany).

Methods

Grape marc was refrigerated (4°C) till the pre-treatments were applied. The used sample did not reach the fermentation stage and consisted of grape peel, seeds and pulp.

Grape marc extraction

Prior to the extraction the grape marc was treated at different temperatures. The samples were dried at 30°C in a thermostatic atmosphere till constant mass using the drying and heating chambers and drying oven (Binder GmbH, Tuttlingen, Germany), or freeze-dried in a lyophilizer, Martin Christ, Alpha 1-2, or only refrigerated at 4°C. Afterwards, all obtained samples were fine grounded using a coffee grinder.

The extraction was performed in distilled water by using 10 g of each sample were treated in distillate water. The grape marc was macerated for 24 h at room temperature, stirred or ultrasounded for 2.5 h. It was also performed an extraction using Soxhlet system for 2.5 h. In all cases the extracts were centrifuged at 15,000 rpm. /10 min. with Rotina 360R system.

The resulting supernatant was used in proportion of 1:10 (V:V extract : hemp retting wastewater).

All determinations were made in triplicate.

Hemp wastewater analysis after grape extracts addition

The wastewater resulted after hemp retting was collected and analysed. pH, conductivity and total dissolved oxygen levels were measured by using a WTW multi-parameter inoLab Multi 740, and for the measurement of the turbidity was used a Turbidimeter (HI 88713 HANNA Instruments).

Results and Discussion

It is well known that textile industry is a high consumer of water resources, and the resulting wastewater has high load of pollutants, usually hard to be removed. Therefore, special attention should be paid, in order to reduce the impact of this industry on the environment.

Even mild treatment of the raw material might lead to wastewater that cannot be discharged into the environment or re-used in the industrial process, without prior treatment.

In our study we considered the wastewater from a mild process from the hemp retting.

In order to, reuse this water for the retting process, we proposed the treatment with different types of grape marc extracts, as presented under the material and methods section.

The wastewater samples were monitored over a period of 8 days, and the chosen parameters are presented in Figure 1-4.

As it can be observed the addition of the extracts to the wastewater does not have a significant impact on pH values, as this remains constant at a value of around 5. The stability of the pH value in the case of the analysed wastewater, allow us to consider that from this point of view the reuse of the water in the retting process is appropriate.

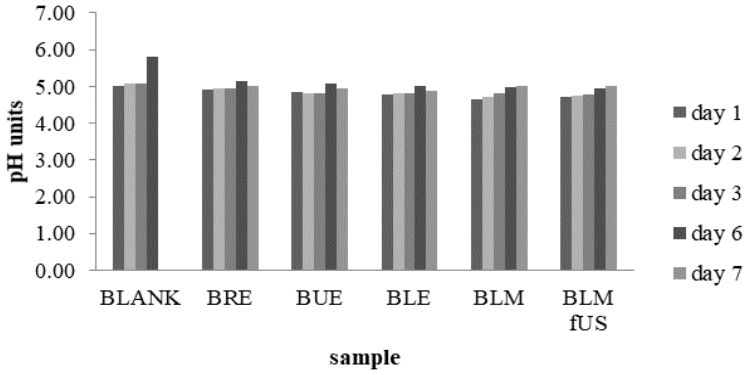

Figure 1. pH variation over 7 days period

The measured values of the turbidity during the same period of time, demonstrated that in all the cases when the different extracts of grape marc was added to the samples of wastewater, the values registered an increase from the first day. Moreover, the values increased till day 6, with a small decreased value registered in day 7. Thereafter the values stabilised at this value. This behaviour can be due to

some remaining yeasts that might be present in the grape marc extracts, and in time some aggregates can be formed.

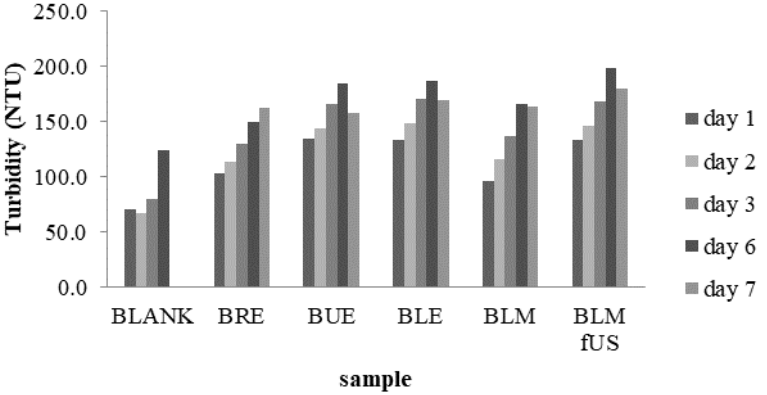

Figure 2. Variation of the turbidity during the monitored period

In the case of the measured values for the dissolved oxygen, it can be observed that over the monitored period there is a drecrease in the concnetration of oxygen, which can explained in the same way as in the case of turbidity. An exception is in the case of the grape marc extract that was treated in ultrasound. In this situation, an abnormal behaviour was observed, and a possible explanation should take into account the effect of ultrasound on the extract composition, but further experiments are needed for fully understanding these results.

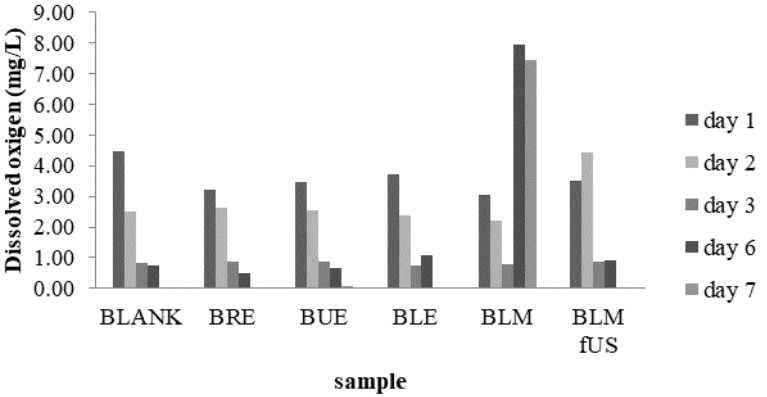

Figure 3. Variation of the level of dissolved oxygen

When the conductivity was monitored, the value remained stable starting with day 7 (data not shown for day 8 till day 14). As a consequence, also in terms of

conductivity, we believe that the wastewater treated in this way can be reused in the hemp retting process.

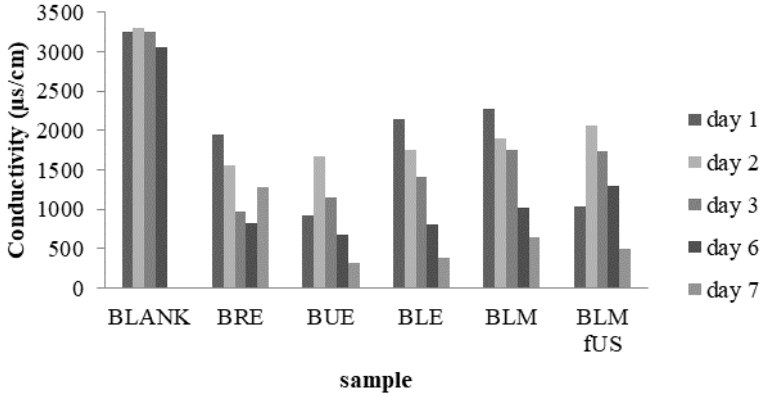

Figure 4. Variation of the conductivity in time.

Conclusions

The monitored parameters (pH, turbidity, dissolved oxygen and conductivity) for the wastewater from hemp retting showed that the addition of different extracts obtained from grape marc can contribute to an improvement of the quality of the analysed water. This suggests that this treatment allows the reuse of the wastewater in the hemp retting process. Further experiments will be performed in order to proof that the obtained fibres, in the case of water reuse, have the same quality as the fibres obtained with clean water used for the retting of hemp.

Acknowledgements

The authors acknowledge financial support from UEFISCDI-PN-III-P3-3.1-PM-RO-FR-2016-0030 (Contract no. 86BM/2017), Valorisation of winery by-products-application for wastewater treatment, „FOODVALUE".

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