Combining ultrafiltration with activated carbon adsorption: synergy for industrial decolourisation of starch hydrolysates

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Introduction

Starch hydrolysates are in the form of glucose syrups obtained after hydrolysis and with a brownish/yellowish colour caused during processing and preservation [1]. Activated carbon (AC) adsorption is the most used method for decolourising glucose syrups [2]. It is responsible for high costs leading to significant AC consumption and a waste product that needs to be appropriately disposed of and treated [3]. This work evaluated the decolourisation of starch hydrolysates, using AC in combination with Ultrafiltration (UF) to develop a cost and resource-effective downstream process in the future.

Materials and Methods

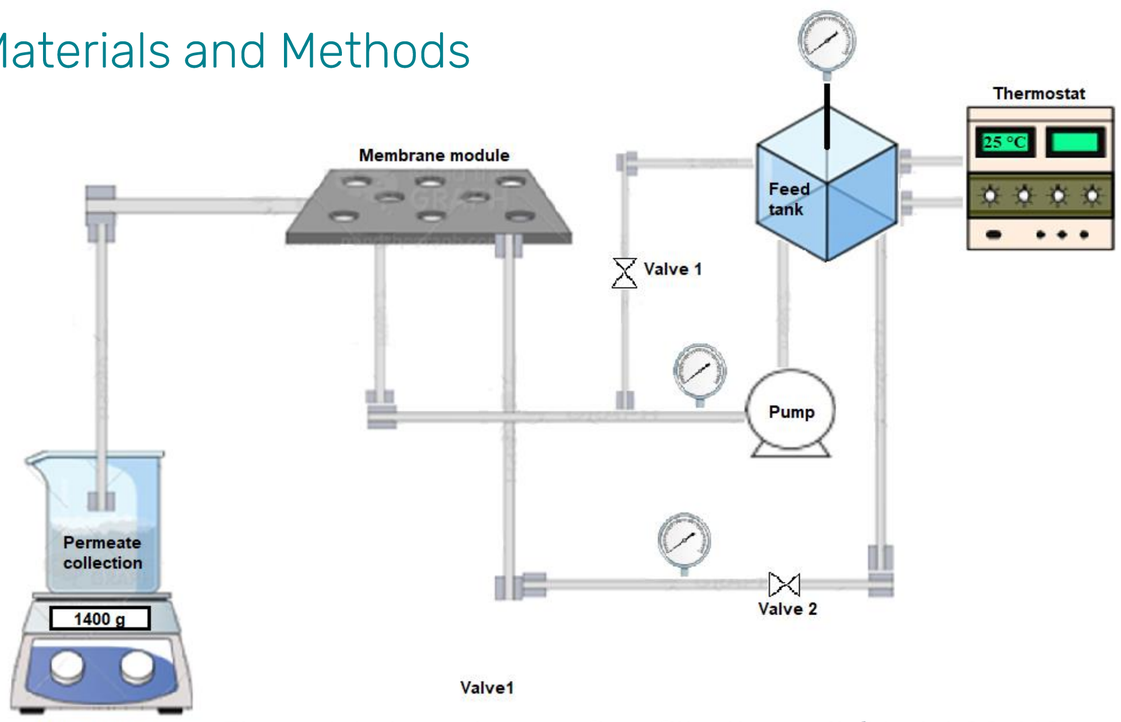


Figure 1. Lab-scale crossflow filtration unit (Model OS-MC-01) effective membrane area = 0,008 m² (0,04m x 0,2m).

Table 1. Characteristics of UF configurations (partial decolourization)

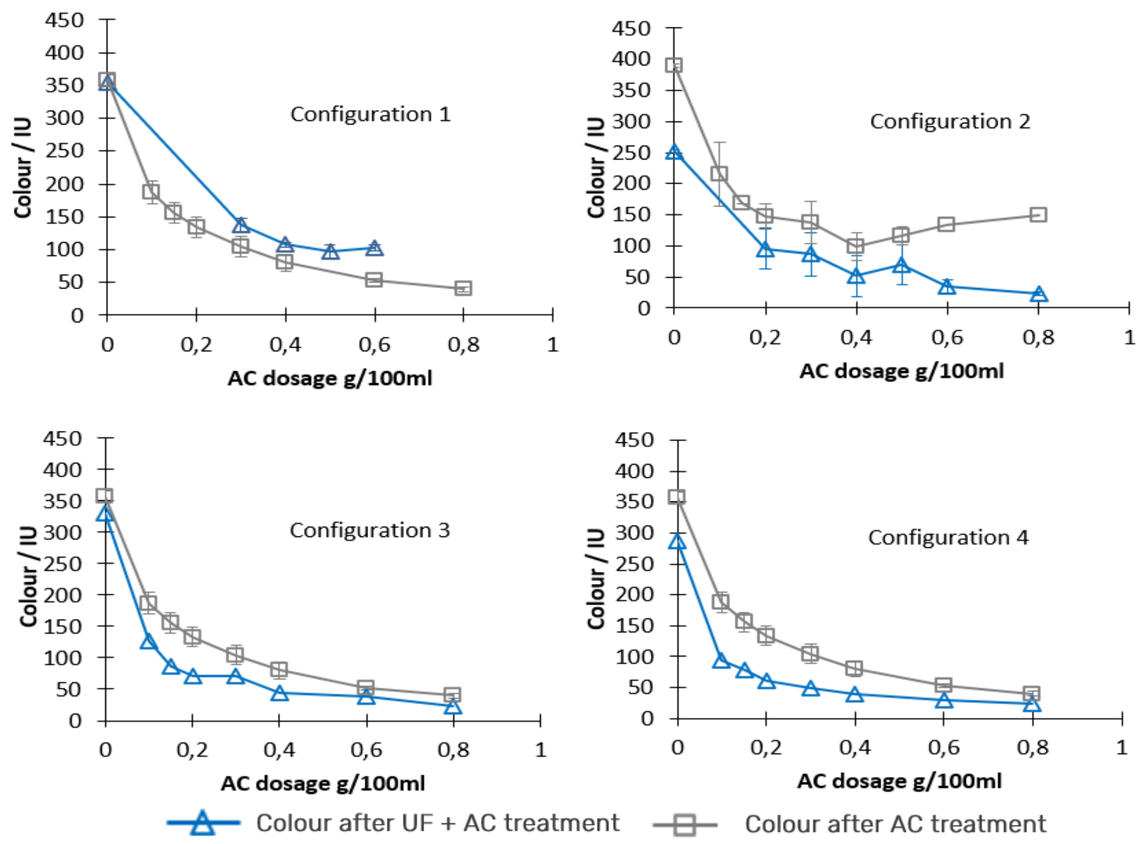
Configuration	1	2	3	4
MWCO (Kg mol^{-1})	100	5	100 – 5 – 0,3	5 – 0,3
Temperature (°C)	60			
Concentration (°Brx)	30			
Pressure (bar)	8		8 -30	

Table 2. Characteristics of AC treatment

Variables	Description
Activated Carbon	Powdered from NORIT GBSP
Dosage (g/100ml)	0.1 to 0.8
Temperature (°C)	70
Adsorption time (min)	40 under shaking
Filtration after AC treatment	4 – 7 µm pore size
Purification targets (IU)	<100

Colour before and after treatments were determined according to ICUMSA spectrophotometrically method (GS2/3-10) at 420 nm used in sugar analysis [4]. Therefore, colour is given in ICUMSA units (IU, international units for sugar colour).

Results



Summary / Outlook

- Partial decolourisation with 100 kDa membrane did not reduce the required AC dosage. However, the 5 kDa membrane reduced the required AC dosage by 50 %.
- Multistage UF obtained the best results reducing up to 74 % of the AC dosage.
- In conclusion, the synergy of UF with AC treatment could be beneficial to decrease AC consumption during the decolourisation of starch hydrolysates while reducing waste generation and costs in the downstream process.
- Future investigation must be carried out that confirms these preliminary results, also evaluating sugar recovery alternatives during the UF process and the AC adsorption mechanisms for better optimisation and design of the new process.

References

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