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1 **Nanoporous membranes with cellulose nanocrystals as**
2 **functional entity in chitosan: Removal of dyes from water**
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11 **Abstract**

12 Fully biobased composite membranes for water purification were
13 fabricated with cellulose nanocrystals (CNCs) as functional entities in chitosan
14 matrix via freeze drying process followed by compacting. The chitosan (10 wt
15 %) bound the CNCs in a stable and nanoporous membrane structure with
16 thickness of 250 -270 μm , which was further stabilized by crosslinking with
17 gluteraldehyde vapors. Scanning electron microscopy (SEM) studies revealed
18 well-individualized CNCs embedded in a matrix of chitosan. Brunauer,
19 Emmett and Teller (BET) measurements showed that the membranes were
20 nanoporous with pores in range of 13-10 nm. In spite of the low water flux
21 ($64\text{Lm}^{-2}\text{h}^{-1}$), the membranes successfully removed 98%, 84% and 70%
22 respectively of positively charged dyes like Victoria Blue 2B, Methyl Violet 2B
23 and Rhodamine 6G, after a contact time of 24 hrs. The removal of dyes was
24 expected to be driven by the electrostatic attraction between negatively
25 charged CNCs and the positively charged dyes.

26 **Key words:** cellulose nanocrystals, chitosan, nanoenabled membranes, dye
27 removal, water purification, adsorption

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