



## Water vapour in Cellulose Acetate and Cellulose Nitrate

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### ● INTRODUCTION

Cellulose acetate (CA) and cellulose nitrate (CN) are two semisynthetic polymers widely found in museum collections. They are considered malignant due to the fact that their degradation products can damage artefacts made of materials such as paper, metals and plastics stored in the proximity<sup>[1]</sup> (Fig.1). It is well known that the key mechanism of CA and CN is hydrolysis<sup>[2,3]</sup>, which is a reaction that occurs between the polymer and water molecules, and affects the acetate and nitrate ester group of the cellulose ring, with the consequence of plasticizer migration and chain scission<sup>[1-3]</sup>.



Fig.1: Antoine Pevsner, Portrait of Marcel Duchamp, 1926. Cellulose nitrate on a support in copper and iron. The corrosion of metal is caused by the emission of nitric acid from CN. © Artists Right Society (ARS), New York/ADAGP, Paris.

### ● EXPECTED OUTCOMES

The results will give information on how the sorption and diffusion of water vapour in plastics depends on the type and amount of plasticizer as well as on polymer type, and the change in the behaviour of water vapour due to ageing of plastics and changes in sensitivity due to environmental factors.

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### ● RESEARCH QUESTIONS

- How do the sorption and diffusion of water vapour changes with the chemical nature of the plastic?
- How do sorption and diffusion depend on the environmental factors such as temperature and relative humidity?

### ● METHODOLOGY

BET technique would be applied to aged CA and CN to analyse how water sorption and desorption change based on sample properties such as chemical composition (analysed using FTIR and XPS), T<sub>g</sub> (determined thanks to DMA) and porosity. Moreover, the change in the interaction between the material and water vapour at different temperatures and relative humidities would be observed.

### LITERATURE

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