SYNTHESIS AND PROPERTIES OF CELLULOSE-BASED HYDROGELS

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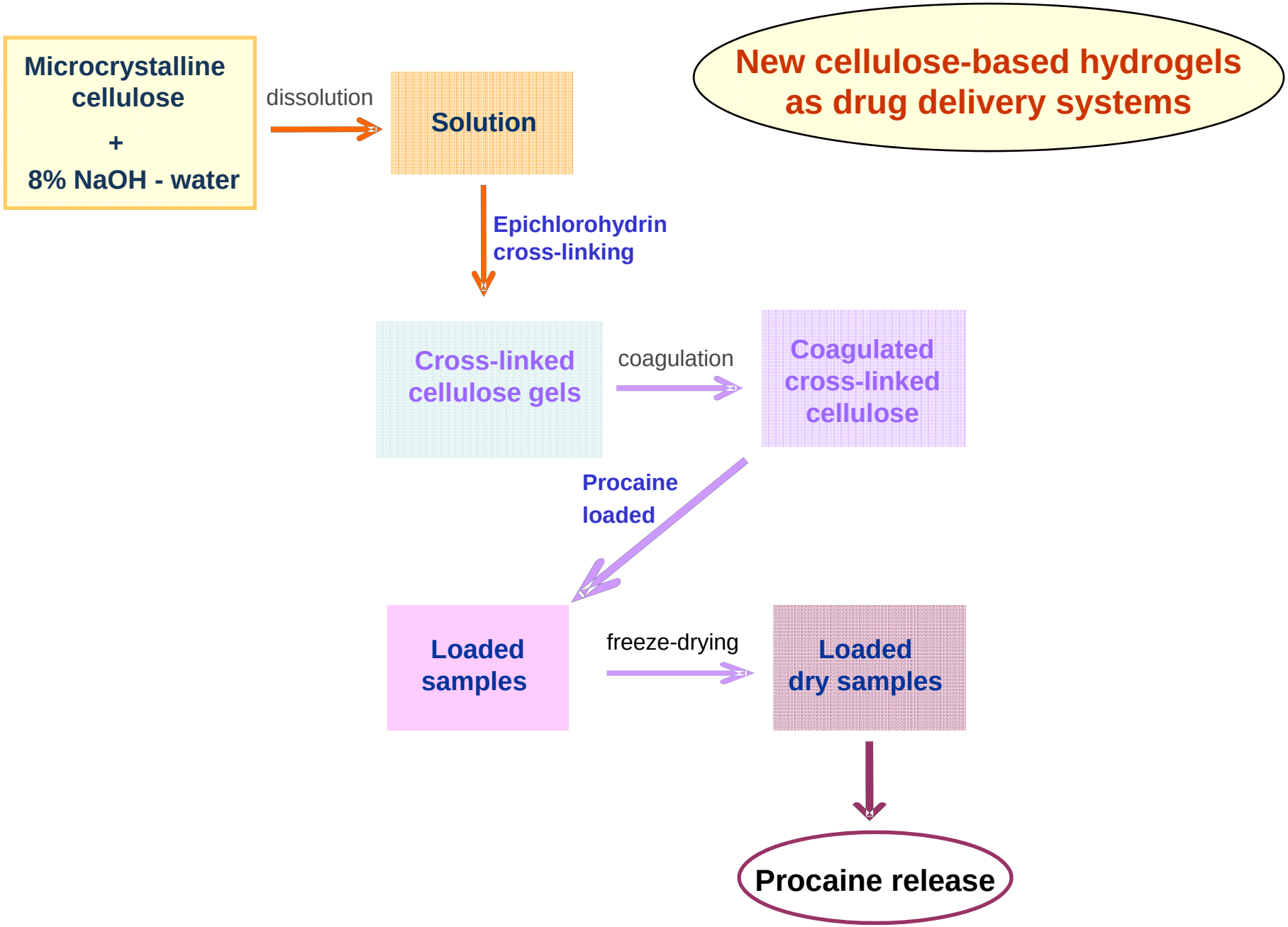
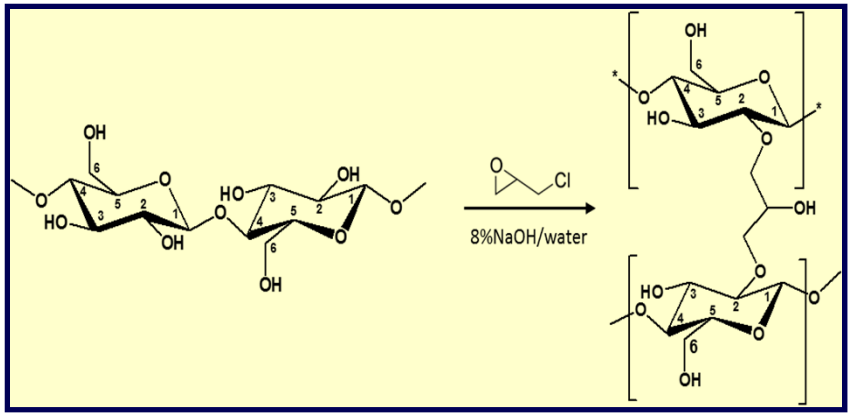

New cellulose-based hydrogels as drug delivery systems
Microcrystalline cellulose
+
8% NaOH - water
dissolution
Solution
Epichlorohydrin cross-linking
Cross-linked cellulose gels
coagulation
Coagulated cross-linked cellulose
Procaine loaded
Loaded samples
freeze-drying
Loaded dry samples
Procaine release

Hydrogels preparation and procaine incorporation



$$R = \frac{n\ mol\ ECH}{n\ mol\ AGU}.$$

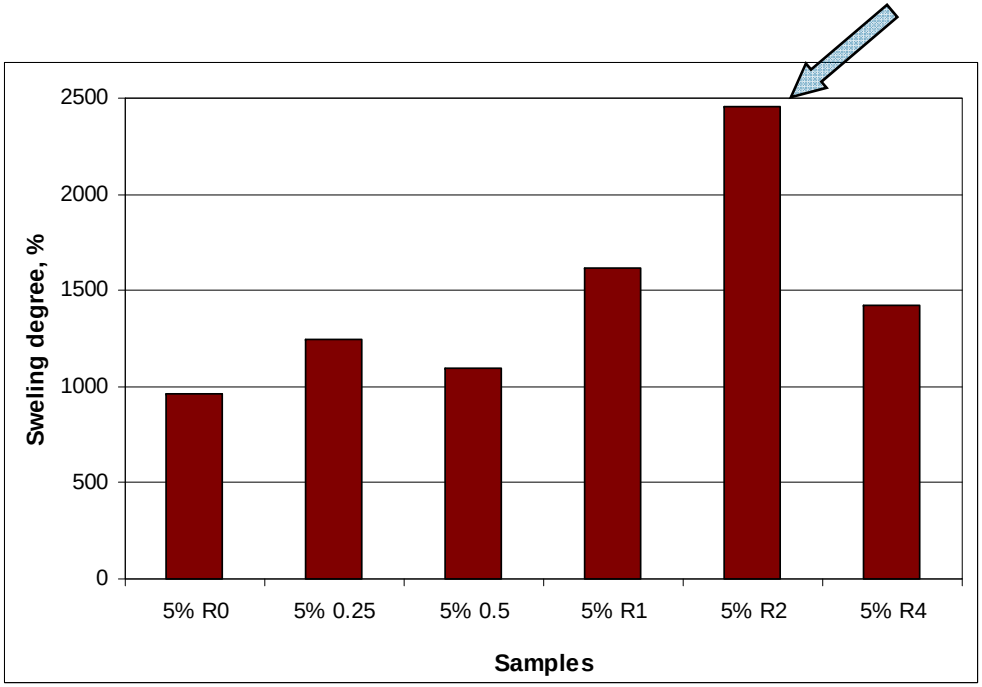
- Relative concentration of ECH in the reaction medium

Sample	C cellulose, %	R	C procaine, g/L
5% R0-2	5	0	2
5% R0-4	5	0	4
5% R0-8	5	0	8
5% R1-4	5	1	4
5% R2-2	5	2	2
5% R2-4	5	2	4
5% R2-8	5	2	8
7% R0-4	7	0	5.2
7% R0.5-4	7	0.5	5.2
7% R1-4	7	1	5.2

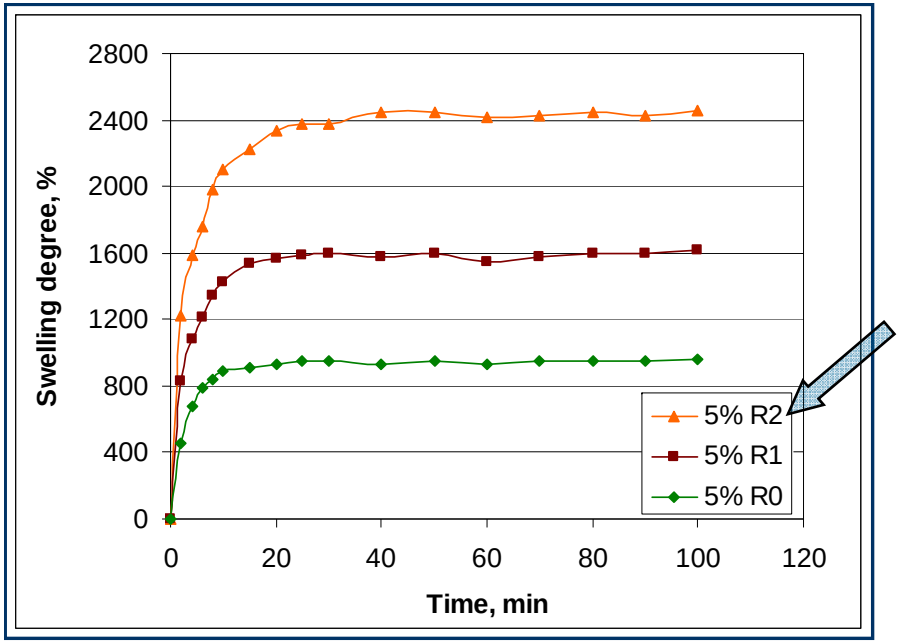
The evaluation of drug release

- **cellulose concentrations (5% and 7%)**
- **degrees of cross-linking (R0, R1, R2 or R0, R0.5, R1)**
- **various procaine loading (2, 4, 8 or 5.2 g/L)**

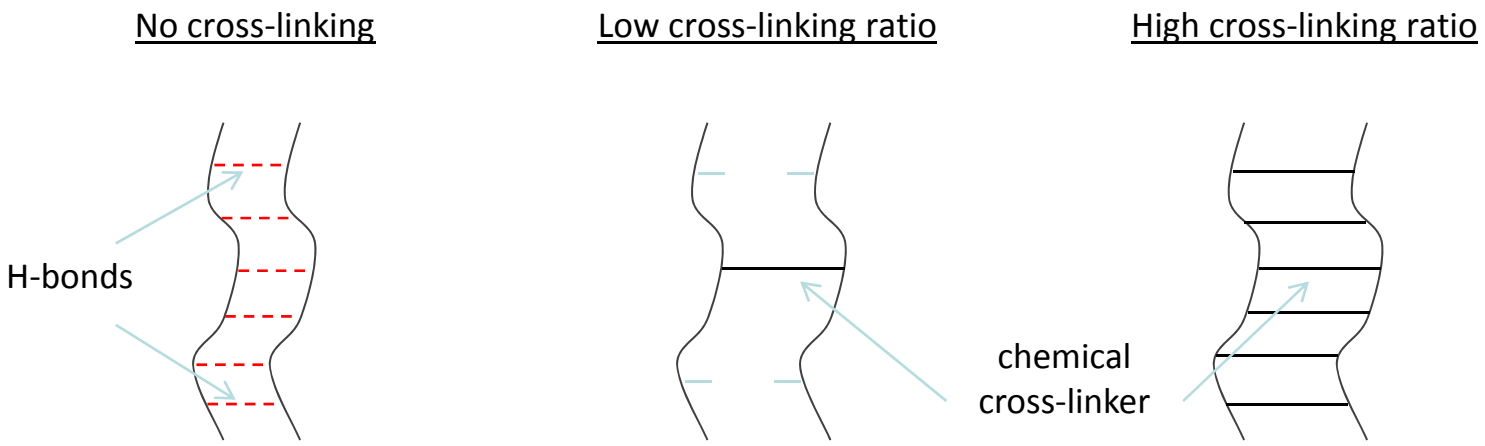
SWELLING MEASUREMENTS



Swelling of hydrogels in water, at 37ºC



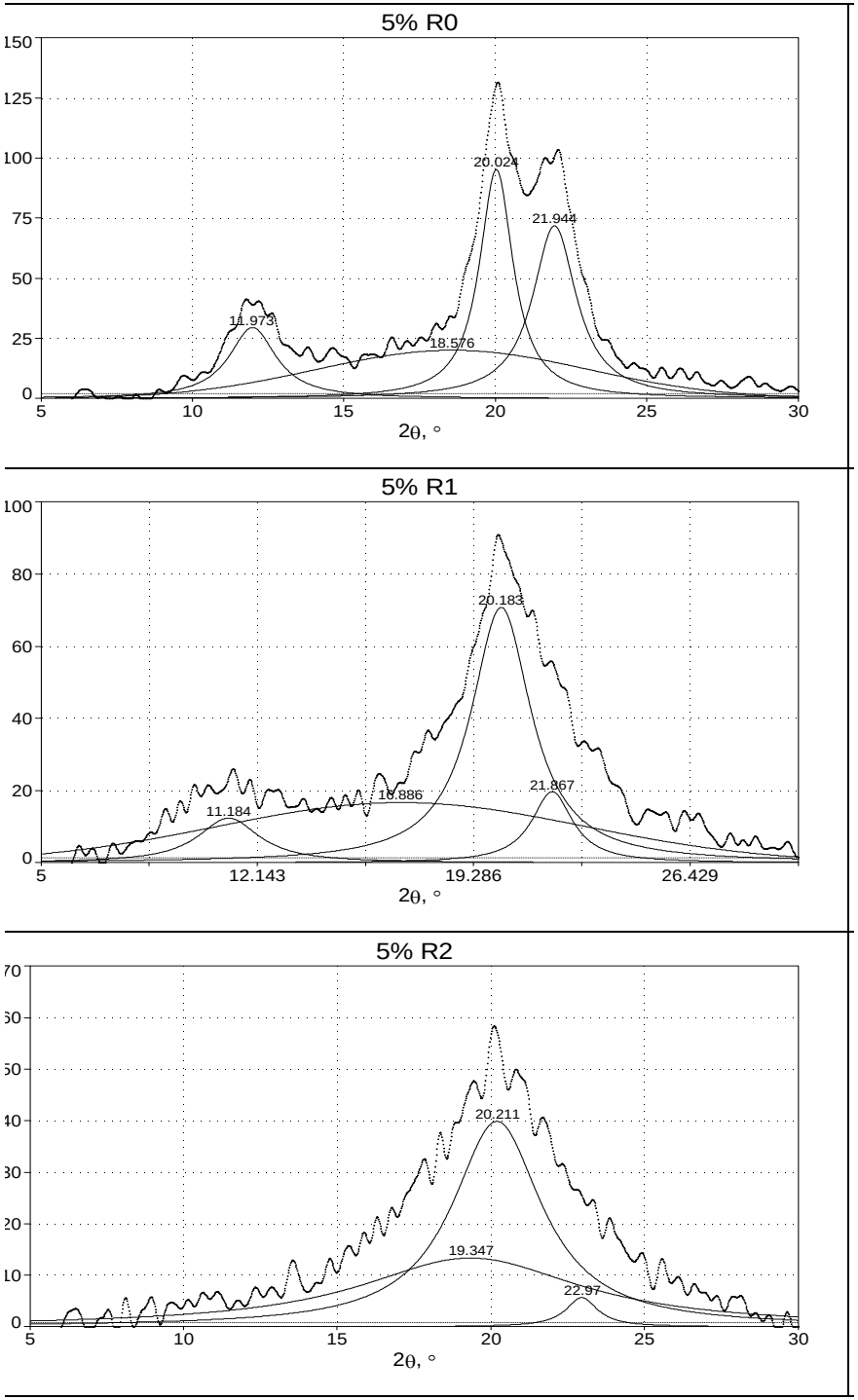
SWELLING MEASUREMENTS



→ **Competition between physical and chemical gelation mechanisms**

- **a low amount of ECH ⟶ acts as a spacer decreasing chains' mobility and preventing the formation of hydrogen bonds.**

- **a higher amount of ECH ⟶ decreasing the amount of "new" pores which leads to the decrease of swelling.**



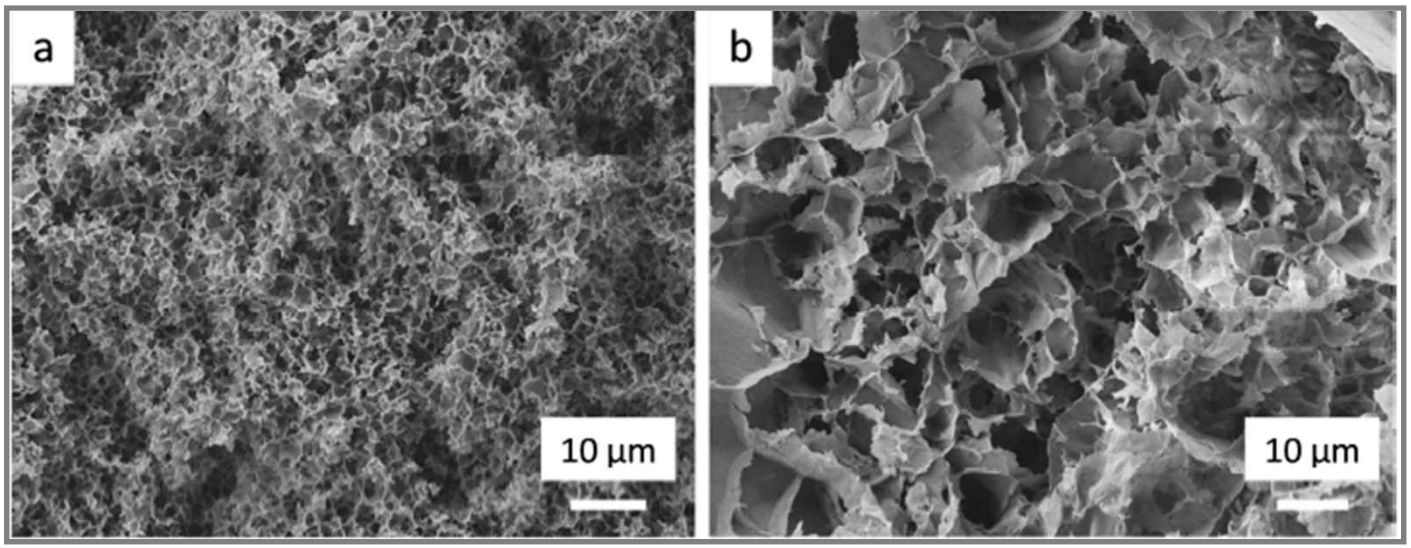
X-RAY DIFFRACTION METHOD

Sample	CrI , %
R0	68
R1	59
R2	44

$$CrI(\%) = [S_C / (S_C + S_A)] \times 100$$

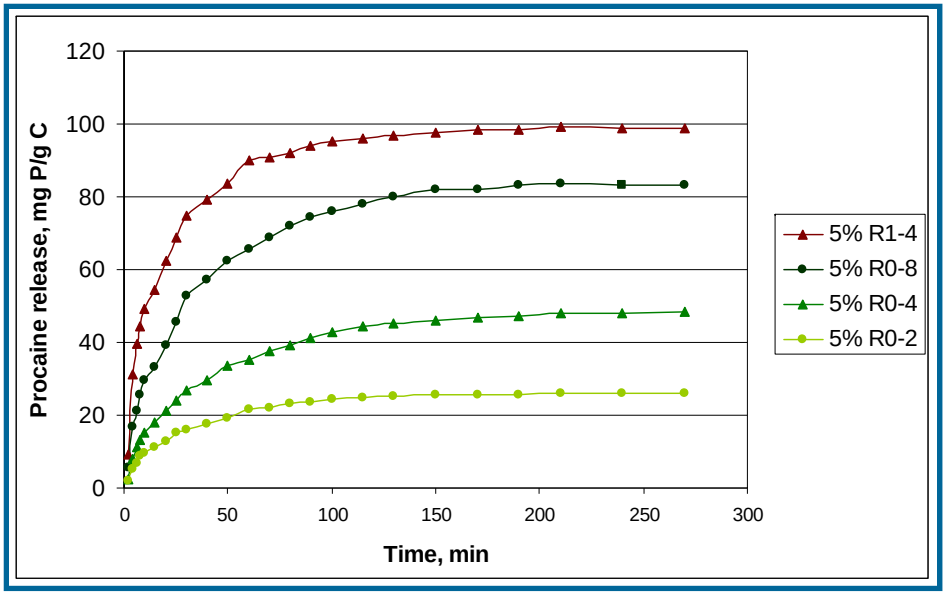
- **Physical cross-linked hydrogels**: **cellulose II difractogram (R0)**
- **Chemical cross-linked hydrogels**: **more amorphous than R0 difractogram**

POROUS MATRIX MORPHOLOGY (SEM)

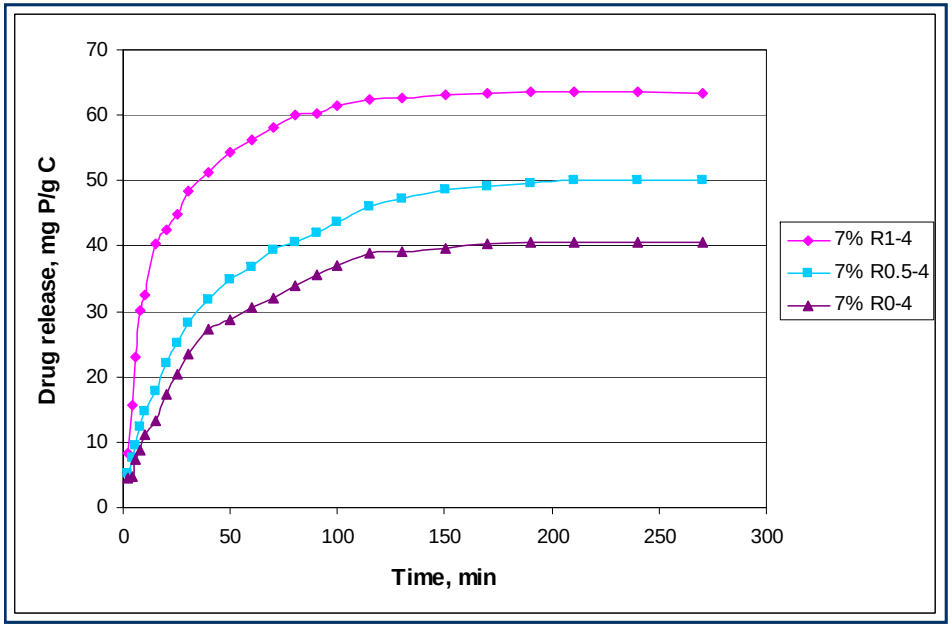


SEM observations of physical (a) and chemical cross-linked (b) hydrogels

DRUG DELIVERY STUDIES



Release profiles of procaine in water, at 37 °C



- **The amount of procaine released in a given period of time can be controlled by selecting the process conditions (cellulose concentrations and degrees of cross-linking) for hydrogels obtaining and the degree of procaine loaded.**

CONCLUSIONS

- New types of cellulose-based hydrogels with various swelling degrees were obtained.
- Chemical cross-linking of hydrogel decreases ordered structure and increases the water absorption ability.
- The amount of the incorporated procaine increased as a function of swelling capacity of the hydrogel.
- The release kinetics of procaine can be controlled by selecting the process conditions (cellulose concentration and cross-linking degree).

THANK YOU FOR YOUR ATTENTION!