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APPLICATION OF SUPERABSORBENT POLYMERS IN THE AGRICULTURE AND THE IMPORTANCE OF THEIR BIODEGRADABILITY - A REVIEW

Ion NIȚU[1], Amalia Carmen MITELUȚ[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania, nituion.11@yahoo.com

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INTRODUCTION

The application of hydrogels in agriculture provide the numerous benefits as: water conservation, resistance to biotic and abiotic drought stress, improved soil quality, decreased seedling mortality, reduced irrigation frequency and water consumption, reduced use of fertilizers and pesticides. They prevent soil erosion caused by surface runoff as well as fertilizer/pesticide leakage into groundwater and also increase soil physical properties by increasing water retention and infiltration capacity, reducing the necessity of continuous watering.

low cost
non-toxicity

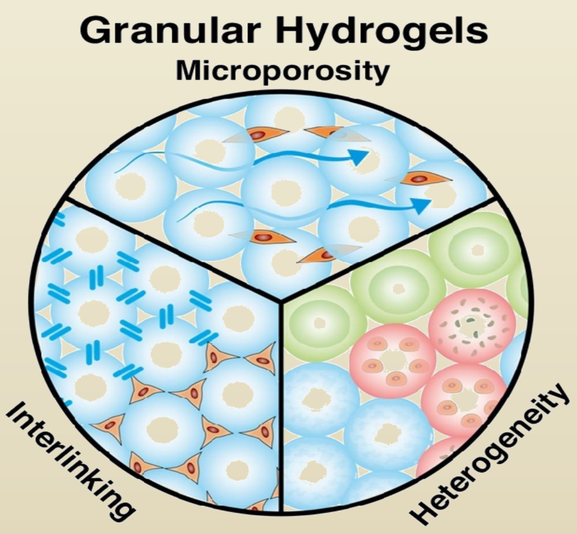
substantial absorption ability
adjustable absorption rate
high absorption when exposed to water

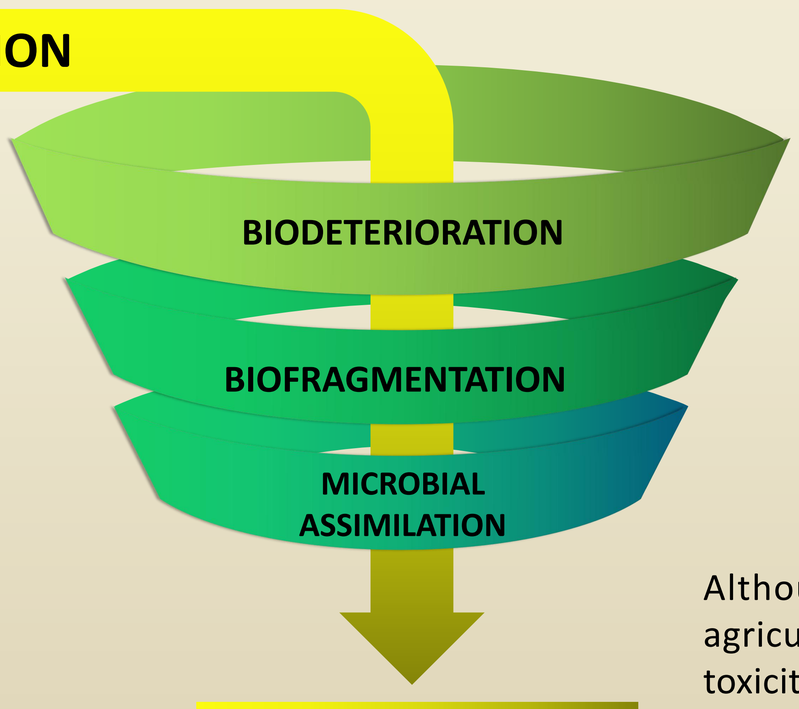
rewetting capacity, biodegradability

high stability after swelling and during storage
high gel fraction after crosslinking

IDEAL AGRICULTURALLY EFFECTIVE HYDROGEL

STAGES OF BIODEGRADATION





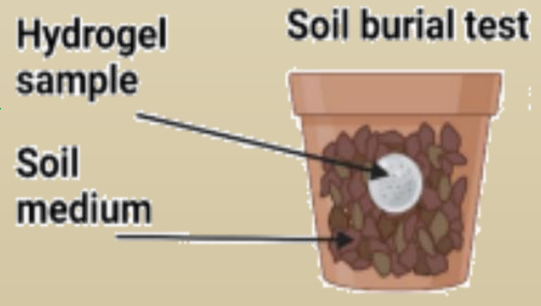
BIODEGRADATION

METHODS FOR ASSESING THE BIODEGRADABILITY OF HYDROGELS

VERMICOMPOSTING

SOIL BURIAL

COMPOSTING



COMPARISON OF THE BIODEGRADABILITY OF HYDROGELS USING THE SOIL BURIAL METHOD

HYDROGEL	MATERIALS	PERCENTAGE OF DEGRADATION	NUMBER OF DAYS
Gum tragacanth-acrylic acid based hydrogel	Gum tragacanth, Acrylic acid	92.29	77
L/KJ/SA hydrogel	Lignosulfonate, Sodium alginate, Konjaku flour	20	120
CS50 hydrogel	Cassava starch, Polyacrylamide	80	30
GG-cl-poly(AA)	Gellan gum, Ammonium persulfate, Acrylic acid, N, N'-methylene bisacrylamide	86.71	22
CAP hydrogel film	Chitosan, Acetic acid, Acrylonitrile, Polyol, Bisacrylamide	90	42
CMC/P4VP hydrogel	Carboxymethyl cellulose, Poly (4-vinylpyridine), N, N- methylene bis-acrylamide	50	5

CONCLUSIONS

Although various studies regarding the application of hydrogels in agriculture showcase their tremendous value, the cost and potential toxicity from biodegradation constitute issues that must be addressed during the following decade by using hydrogels that use non-toxic materials, possess elevated capability to absorb water, excellent functionality even at high temperatures, and, most importantly, high biodegradability without the generation of harmful compounds.

REFERENCES

Barajas-Ledesma, R.M., Stocker, C.W., Wong, V.N.L., Little, K., Patti, A.F & Garnier, G. (2022). Biodegradation of a Nanocellulose Superabsorbent and Its Effect on the Growth of Spinach (Spinacea oleracea). *Agricultural Science & Technology*, 2, 90-99.

Choudhary, S., Sharma, K., Bhatti, M.S., Sharma, V. & Kumar, V. (2022). DOE-based synthesis of gellan gum-acryl acid-based biodegradable hydrogels: screening of significant process variables and in situ field studies. Royal Society of Chemistry, 12, 4780-4794.

Devi, L. & Gaba, P. (2019). Hydrogel: An Updated Primer. Journal of Critical Reviews, 6(4), 1-10.

Song, B., Liang, H., Sun, R., Peng, P., Jiang, Y. & Se, D. (2020). Hydrogel synthesis based on lignin/sodium alginate and application in agriculture. International Journal of Biological Macromolecules, 144, 219-230.