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Radiation Processing of Natural Polymers for Industrial Applications

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Abstract

Radiation induced degradation technology is a new and promising application of ionizing radiation to develop viscose, pulp, paper, food preservation, pharmaceutical production, and natural bioactive agents industries. Controlling the degree of degradation, uniform molecular weight distribution, saving achieved in the chemicals (used in conventional methods) on a cost basis, and environmentally friendly process are the beneficial effects of using radiation technology in these industries. However, for some development countries such technology is not economic. Therefore, a great effort should be done to reduce the cost required for such technologies. One of the principle factors for reducing the cost is achieving the degradation at low irradiation doses. The addition of some additives such as potassium per-sulfate (KPS), ammonium per-sulfate (APS), or H₂O₂ to natural polymers (carboxy-methylcellulose (CMC), chitosan, carageenan and Na-alginate) during irradiation process accelerates their degradation. The highest degradation rate of polysaccharides obtained when APS was used. The end product of irradiated CMC, chitosan, carageenan and Na-alginate may be used as food additive or benefited in agricultural purposes. On the other hand, radiation crosslinking of PAAm or PNIPAAm is affected by the presence of natural polymer like CMC-Na and carageenan due to their degradability which could be controlled according to its concentration in the bulk medium and irradiation dose. Accordingly, the gel content, thermo-sensitivity (LCST) and swelling properties of PNIPAAm based natural polymers could be controlled. The swelling of the prepared copolymer hydrogels was investigated for its possible use in personal care articles particularly diapers or as carriers for drug delivery systems. The prepared crosslinked copolymers possessed high and fast swelling properties in simulated urine media and the swelling ratios of CMC-Na /PAAm gels in urine are acceptable for diaper application.