

Abstract Submitted
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Thermal-induced ageing of agar solutions: impact on the structural and mechanical properties of agar gels¹ BOSI MAO, Centre de Recherche Paul Pascal, AHMED BENTALEB, FRÉDÉRIC LOUERAT, THIBAUT DIVOUX, PATRICK SNABRE, Centre de Recherche Paul Pascal - CNRS — Numerous hydrogels are prepared by cooling down to ambient temperature, aqueous polymer solutions brought to a boil. Although the incubation time of the polymer solution at such a high temperature could be used as a tuning parameter, its impact on the subsequent gelation has been poorly investigated. Here we study the effect of prolonged heating at 80°C on a 1.5% wt solution of agar, a natural polysaccharide. The incubation time is varied from a few hours up to five days. We show that the agar sol. continuously degrades as the result of both the hydrolysis and the intermolecular oxidation of the polymer chains. Furthermore, electronic microscopy and X-ray diffraction experiments reveal that gels formed from older agar sols display an increasingly coarser microstructure composed of micron-sized aggregated pieces of polysaccharides, in contrast with the fibrous-like structure of gels made from fresh sols. Along with structural changes prolonged incubation time leads to weaker gels of lower shear elastic modulus. Finally, macro-indentation experiments coupled to direct visualization show that increasing the incubation time of the agar sol. decreases the yield strain of the gel by a factor of three, while the rupture scenario turns continuously from brittle to ductile-like.

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