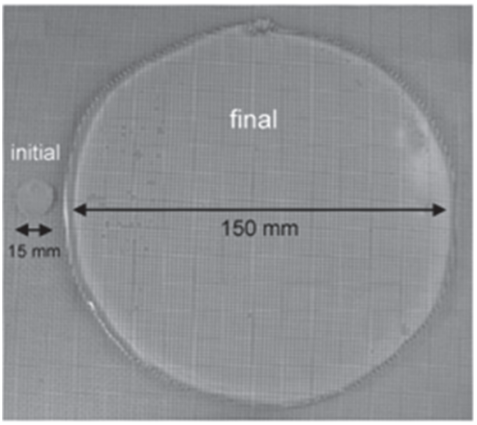

Fig. 18. The typical behaviour of a superadsorbent hydrogel. The native gel is a disk of 15 mm diameter, in water the diameter is 10 times that of the previous one.

Pores are important for purification or any other processes for which a faster mass transport (such as drying) is desired (Arndt et al. 2009; Omidian and Park 2010). Physical and chemical stability of a hydrogel decreases at higher pore concentration. Pores can lose their structural integrity during storage depending on the water content of the hydrogels, the storage temperature, and the relative humidity of the storage environment. The porosity of hydrogel may be divided into four main classes; non-porous, micro-porous, macro-porous and super-porous hydrogels (Dorkoosh et al. 2002). Non-porous gels show molecular size pores equal to the macromolecular correlation length (10–100 A), while micro-porous (100–1000 A) and macro-porous (0.1–1 μm) hydrogels have larger pores. The size of pores in super-porous hydrogels (SPHs) is usually in the range of several hundred micrometers, which are connected to form the open channel system and act as a capillary system, causing a rapid uptake of water into the aqueous solution to equilibrium state in a matter of a minute regardless of their size (Hammer et al. 2013) (Fig. 19). We must always take into account how crucial the dimension of walls between the pores is for the response time. Porous gels swell or shrink very fast compared with nonporous gels of the same size.

Achilleos et al. have developed a technique for the real-time visualization of dynamic deformation profiles during gel swelling processes (Achilleos et al. 2000). The system, which is based on caged photo-activated fluorophores covalently attached to the gel network, can provide quantitative information on transport fields such as polymer deformation and concentration. Based on this technique and other simulations (Kojima et al. 1998), it is obvious that swelling is not a continual process.

On the other hand, in the hydrating hydroxypropylcellulose (HPC) tablet, the growth of the gel layer can clearly be seen, the size of the dry core decreased as more of the table became hydrated. In addition, as shown in Fig. 20 an interface layer between the dry core and the gel layer is clearly recognized (Kojima et al. 1998). It was confirmed through images of MRI that there three moieties: gel layer, interface layer and dry core in the hydrating HPC tablet. One of the very important features of hydrogel swelling is the rate of swelling or swelling kinetics. Osmotic pressure