

Time (Minutes)	Ethanol Concentration (g/l)
10	1
120	1.8
225	3.4

The sample taken after 10 minutes approximates the results expected from a single pass of the dextrose solution through the gel-in-foam in the syringe barrel.

#### EXAMPLE 7

This Example illustrates the use of a partially-dewatered gel-in-matrix that has utility as an ion exchange medium.

A hot aqueous solution containing 0.25 wt % carboxymethyl agarose and 0.75 wt % SeaKem® ME agarose was used to saturate a small block of reticulated open-cell (100 ppi) flexible polyurethane foam. The gel solution in the foam was allowed to gel by cooling and then manually squeezed between two plates of acrylic plastic to fracture the gel contained within the foam matrix and express water. The partially-dewatered gel-containing foam matrix was then contacted with water to rehydrate the gel-containing foam.

A protein solution containing 1% cytochrome c at ambient temperature was then dripped through the gel-in-foam until the gel-containing foam matrix had been saturated with this red-colored protein solution. Water was then dripped through to wash the gel-in-foam and remove protein not ionically bound to the agarose. This continued until the liquid flowing out of the gel-containing foam was observed to be clear.

An aqueous salt solution (1M NaCl) was thereafter run through the gel-containing foam to unbind the protein. Shortly after this was begun, the effluent liquid was observed to be very red in color, indicating that the ionically-bound protein was readily eluted with the salt solution flowing through the fracture channel network in the partially-dewatered gel-in-matrix ion exchange medium.

#### EXAMPLE 8

This example illustrates a partially dewatered gel in a foam matrix used in gel permeation chromatography.

A hot solution containing 4 wt % SeaKem® LE agarose was used to saturate a cylindrical foam plug of reticulated open-cell (100 ppi) flexible polyurethane foam, 150 mm long by 12 mm diameter. The agarose solution was allowed to gel in the foam matrix by cooling and thereafter the foam plug was manually squeezed between two plates of acrylic plastic to fracture the gel contained within the foam matrix and express water. The partially dewatered gel-in-foam matrix was rehydrated with distilled water. The squeezing/compression/rehydration procedure with water was repeated two more times. The gel-containing cylindrical foam plug was then encased in a column by fitting the plug with inlet and outlet nipples and potting the plug and nipples in waterproof epoxy.

A gel permeation chromatography procedure was run under the following conditions:

Sample	0.1 ml of 0.1% blue dextran and 0.1% adenosine triphosphate
Eluant	0.2 wt % NaCl
Eluant Flow Rate	16 ml/hour

-continued

Column Head	160 cm
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Flow and flow rate observation during this procedure indicated the column contained a void volume of about 6%. The gel permeation chromatography experiment resulted in a clear separation of the blue dextran from the adenosine triphosphate.

We claim:

1. A gel-in-matrix combination comprising a three-dimensional porous support matrix and a porous fractured hydrogel fixedly disposed therein, in which said fractured hydrogel has: (a) a void volume of about 10-90%; and (b) a plurality of porous fractures comprising channels having a mean characteristic dimension of about 0.1-1,000  $\mu\text{m}$ .

2. The gel-in-matrix of claim 1 wherein said fractured hydrogel void volume is about 50-90%.

3. The gel-in-matrix of claim 1 wherein said hydrogel fracture channels have a mean characteristic dimension of about 1-100  $\mu\text{m}$ .

4. The gel-in-matrix of claim 2 wherein said hydrogel fracture channels have a mean characteristic dimension of about 1-100  $\mu\text{m}$ .

5. The gel-in-matrix of claim 1 wherein said hydrogel is thermally reversible to a liquid.

6. The gel-in-matrix of claim 1 wherein said hydrogel is a polysaccharide which is thermally reversible to a liquid.

7. The gel-in-matrix of claim 1 wherein said hydrogel is an alginate, carrageenan, agar, agarose, curdlan, pululan, gellan, a derivatized composition of any of the foregoing, or a mixture thereof.

8. The gel-in-matrix of claim 3 wherein said hydrogel is an alginate, carrageenan, agar, agarose, a derivatized composition of any of the foregoing, or a mixture thereof.

9. The gel-in-matrix of claim 4 wherein said hydrogel is an alginate, carrageenan, agar, agarose, a derivatized composition of any of the foregoing, or a mixture thereof.

10. The gel-in-matrix of claim 1 wherein said hydrogel is an agarose or derivatized agarose.

11. The gel-in-matrix of claim 4 wherein said hydrogel is an agarose or a derivatized agarose.

12. The gel-in-matrix of claim 1 wherein said hydrogel comprises about 0.05-10% w/w gel-forming component based upon the total gel.

13. The gel-in-matrix of claim 11 wherein said hydrogel comprises about 0.05-10% w/w gel-forming component based upon the total gel.

14. The gel-in-matrix of claim 1 wherein said matrix comprises a material inert with respect to the hydrogel, having pores with a mean characteristic dimension of less than about 2 mm.

15. The gel-in-matrix of claim 13 wherein the matrix comprises a material inert with respect to the hydrogel, having pores with a mean characteristic dimension of less than about 2 mm.

16. The gel-in-matrix of claim 1 wherein said matrix is hydrophilic.

17. The gel-in-matrix of claim 15 wherein said matrix is hydrophilic.

18. The gel-in-matrix of claim 1 wherein said matrix is a porous: plastic, ceramic, metal, flexible plastic foam, rigid plastic foam, or mass of nonwoven fibers.