



(12) **United States Patent**  
**Hellerbrand et al.**

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(54) **PROCESS FOR STABILIZING PROTEINS**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**<sup>7</sup> ..... **C12Q 1/34**; C12N 9/96;  
C12N 5/02; G01N 33/53; A61K 39/395

(52) **U.S. Cl.** ..... **424/130.1**; 435/188; 435/963;  
435/390; 530/387.1; 530/350; 530/380;  
424/177.1

(58) **Field of Search** ..... 530/350, 380,  
530/387.1, 390.5; 435/390.5, 188, 963,  
18; 424/177.1, 130.1

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(57) **ABSTRACT**

An aqueous protein solution buffered with a potassium  
phosphate buffer, in which the ratio of potassium ions to  
sodium ions in the solution is at least 10:1, is resistant to the  
formation of protein aggregates and particles under condi-  
tions of freezing, thawing, lyophilization, and reconstitution.

**45 Claims, 4 Drawing Sheets**

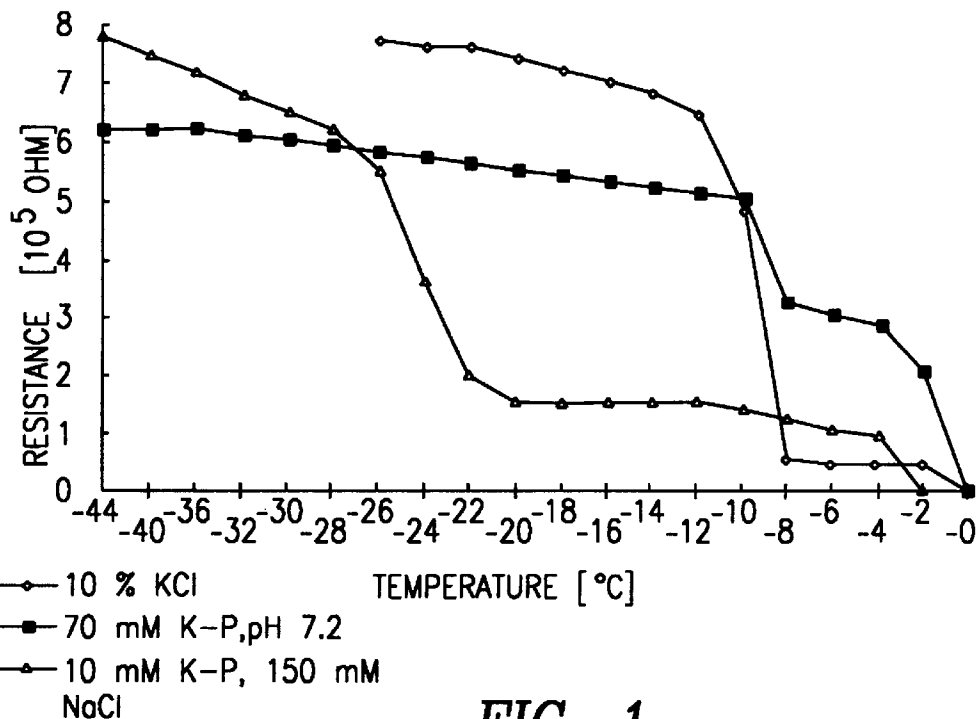


FIG. 1

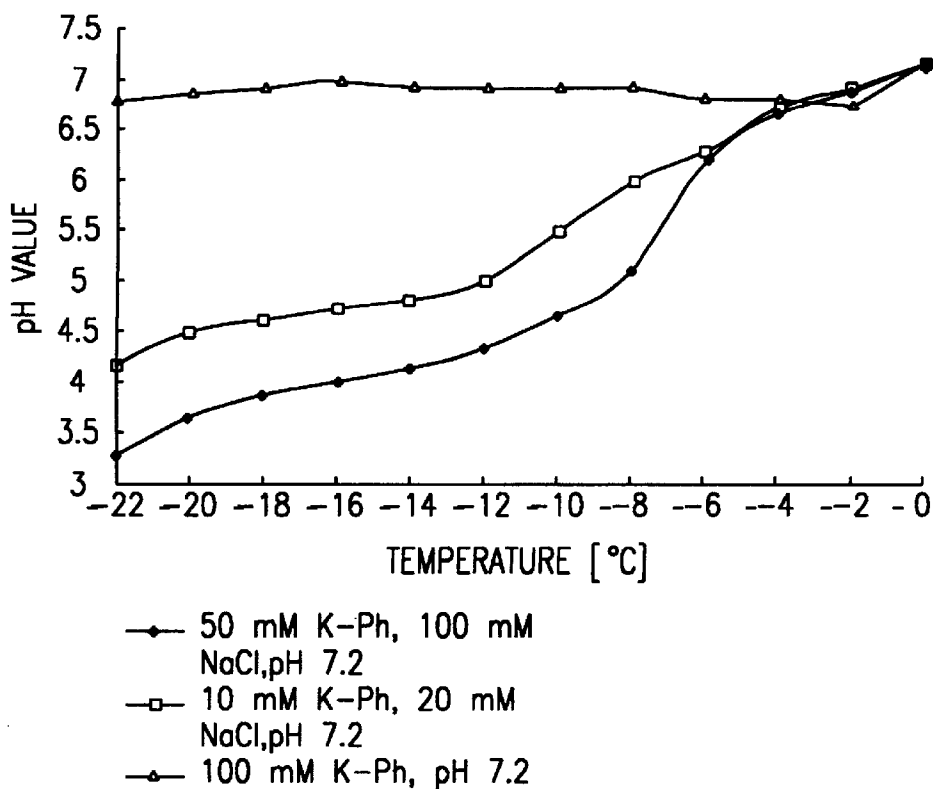


FIG. 2

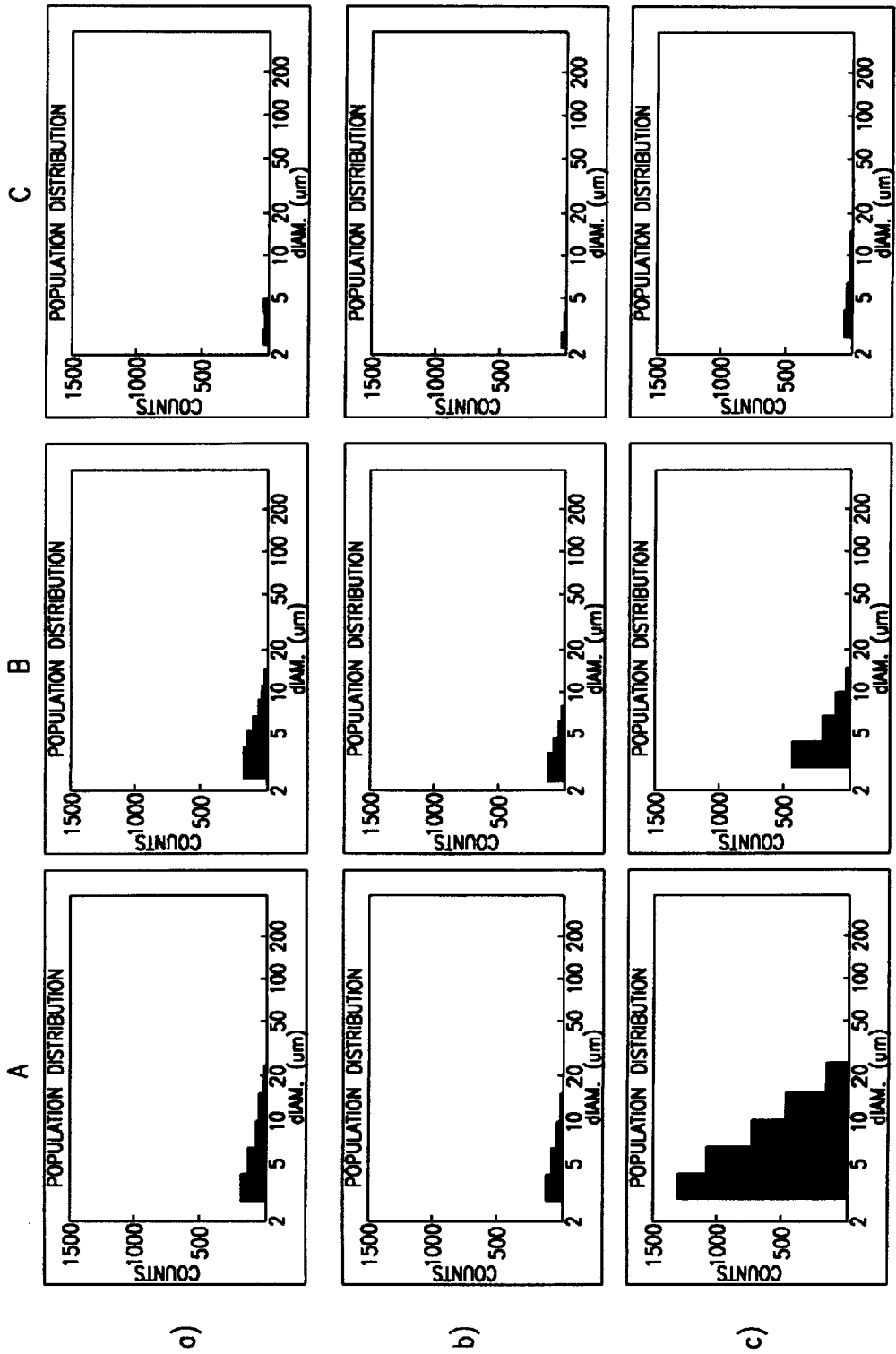


FIG. 3

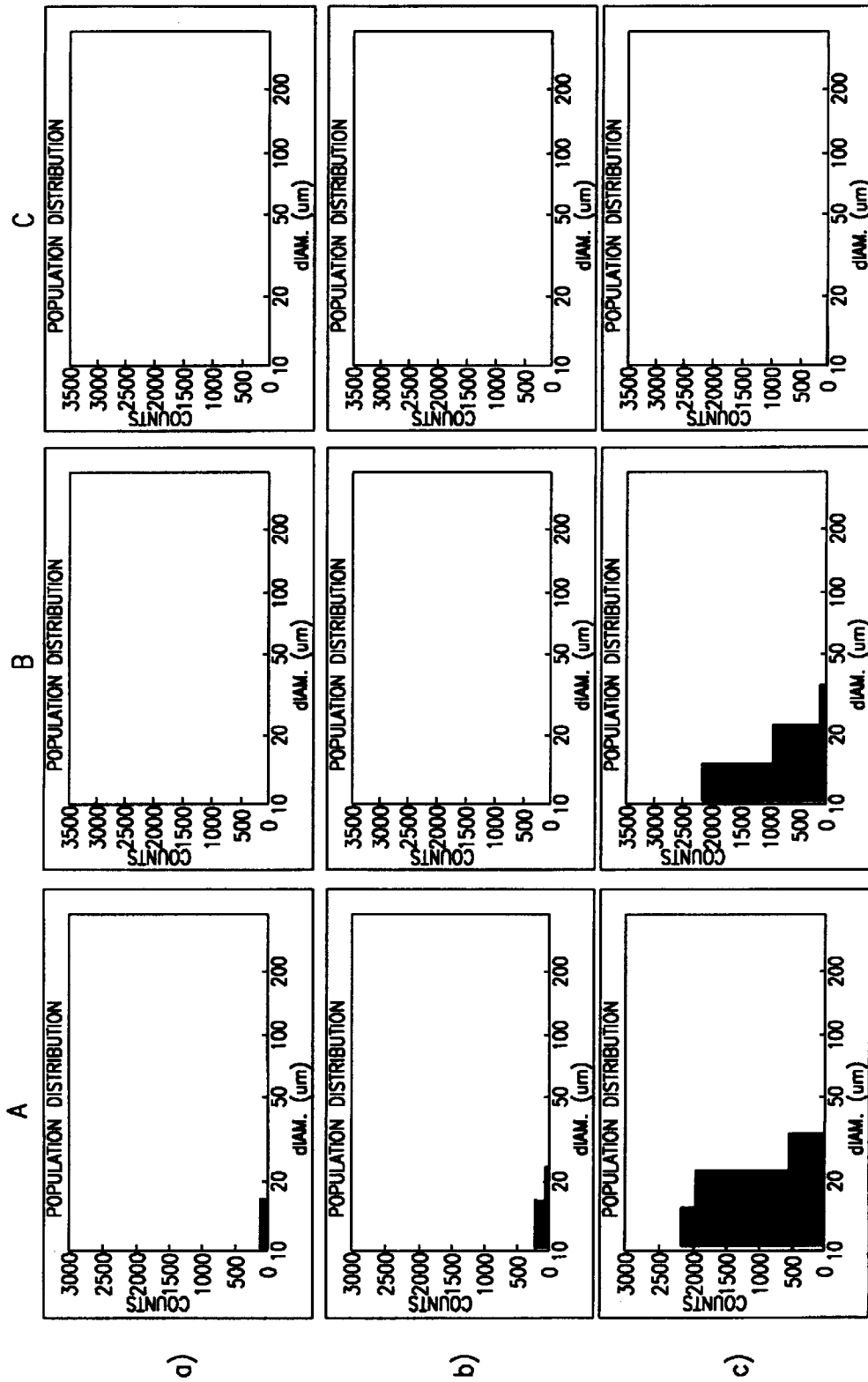


FIG. 4

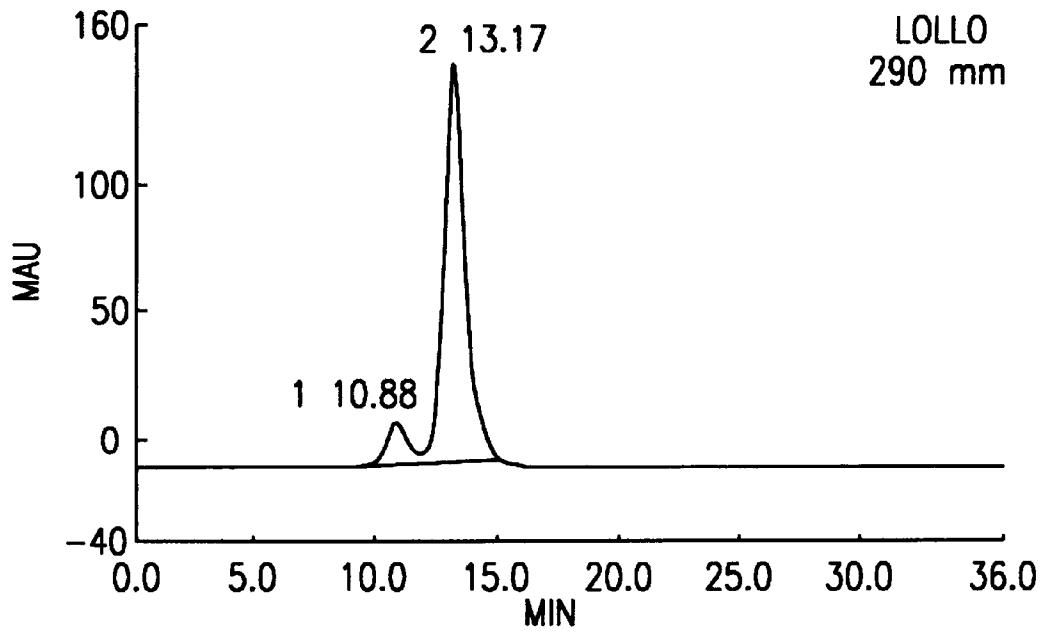


FIG. 5A

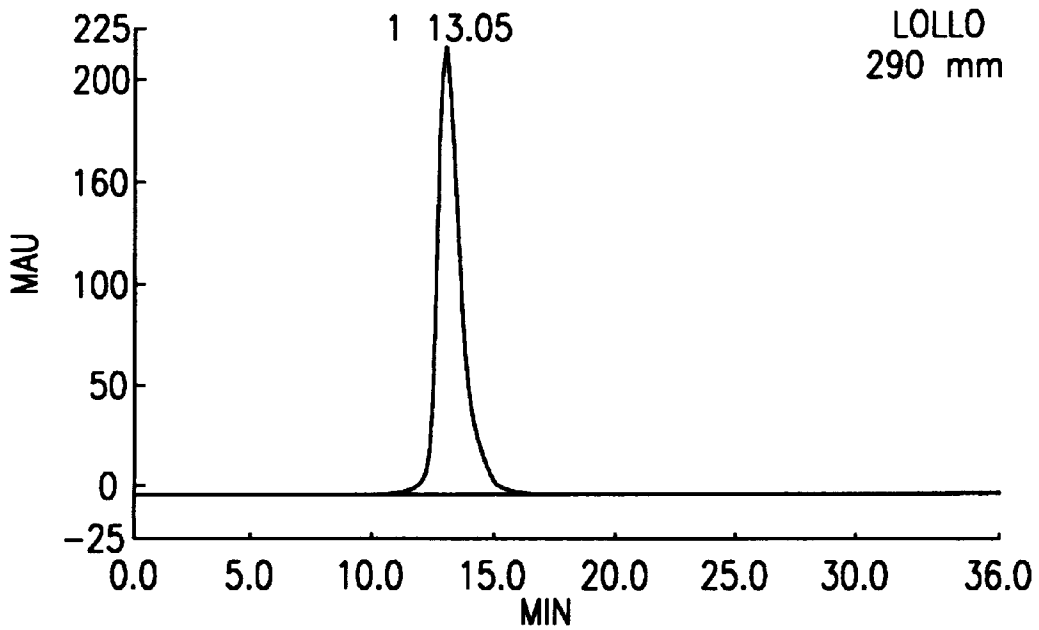


FIG. 5B

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