Synthesis of functional proteins using the translation machinery entrapped in sol-gel matrix

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One of the most attractive features of cell-free protein synthesis is that the events of gene expression can be reproduced in an artificial environment that has been designed for specific purposes.
Herein, we report sol-gel immobilization of bacterial translation machinery and its use for cell-free protein synthesis. The translation machinery of E.coli was entrapped within a silica gel matrix simply by mixing the S30 extract with alkoxysilane monomers prior to the initiation of sol-gel reaction. Interestingly enough, ribosome and other translation factors survived the harsh conditions of immobilization, and were able to decode the co-immobilized DNA into functional protein molecules. In addition, use of appropriate additives enabled the control of pore size of the gel matrix, thereby facilitating the supply of the substrates for protein synthesis. To the best of our knowledge, this is the first report describing the synthesis of protein using the translation machinery immobilized in inorganic material. We expect that the developed technology will find a wide variety of applications including high-throughput protein expression and the developments of protein chip and biosensors.