Study on Protecting Functional Factors of Food Protein Carrier System Based on Functional Nanomaterials

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Abstract: In recent years, more and more researchers have begun to realize the importance of physiological activity of functional factors, and the evaluation of digestion and absorption of functional factor delivery system has attracted great attention. In this study, extrusion spheronization and fluidized bed film coating technology were used to construct a film-coated pellet delivery system of acetate-resistant starch based on liquid food system, and the factor protection of the function of food protein carrier system based on functional nanomaterials was studied. The in vitro digestion and absorption model and evaluation technology of food functional factor delivery system were systematically introduced. The new methods of nanomaterials in the protection analysis of functional factors of food protein carrier system were systematically reviewed, and the future development of kinase activity analysis method was prospected.

1. Introduction

With the rapid development of economy, the increase of work pressure and the improvement of living standards, more and more sub-healthy people, aging people and adolescents and children with malnutrition are in the world. The change of disease pattern and health pursuit makes people realize that the treatment is inferior to prevention, and begin to shift from heavy treatment to heavy prevention [1]. In recent years, with the rapid development of nanotechnology and functional nanomaterials, the performance of biosensors has been improved to a new level. To realize the physiological function of functional factors, we need to rely on certain carrier materials to process functional foods successfully, which can be absorbed and utilized in the corresponding parts after being taken by human body [2]. Among them, protein phosphorylation is the most basic and most common mechanism for regulating and controlling protein activity, and it is also one of the most effective and important regulatory pathways in organisms. Surfactant aggregates in the nano-state as a food function factor carrier have significant advantages such as stable performance, simple preparation, and low cost, and have been initially used in pharmaceutical preparations [3]. Therefore, as a protein purification technology with broad application prospects in the fields of biomimetic sensors, column applications, protein enrichment and purification, mold antibodies, disease detection and diagnosis, protein molecular imprinting technology has been more and more researchers. The attention has become a research hotspot in recent years.

At present, previous studies have involved the storage stability and bioavailability of functional factors, but the research only involves one aspect, and the two have not been comprehensively considered. The purpose of this paper is to comprehensively reflect the recent advances in the application of nanomaterials to the analysis of protein kinase activity. Based on a brief summary of the molecular recognition methods and principles in conventional kinase assays, and based on different analytical techniques, this paper systematically reviews the nanomaterials in protein kinases. Various new methods in activity analysis [4]. The appropriate crosslinking agent and initiator were selected and added into the prepolymer under certain conditions. Under the action of crosslinking agent, the template molecule-functional monomer complex was polymerized to obtain the polymer [5]. These aggregates have different microenvironments with different lipophilic/hydrophilic properties at the same time, but macroscopically they are homogeneous multi-phase systems, which can solubilize both polar and non-polar substances, thus having important application value in changing the appearance, quality and efficacy of liquid food.

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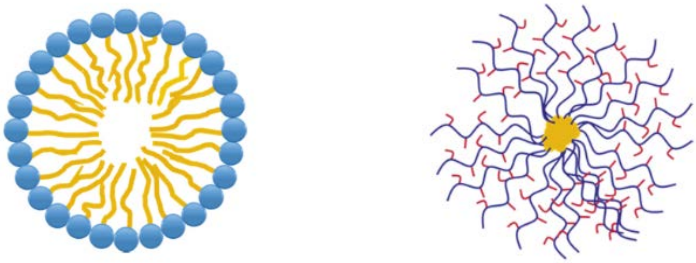
2. Methodology

The ideal carrier of food functional factors should have the following characteristics: sealing the core material in its structure during food processing and storage, so as to isolate the core material from the external environment to the greatest extent; not reacting with the core material; good sustained release effect and operability. Bile salts and trypsins play an important role in the digestion of functional factors [6]. Lack of bile salt almost inhibits micellization of functional factors, and bile salt and trypsin have synergistic effects in the digestion of functional factors. The storage stability and controlled release of functional factors are achieved by a certain controlled release microencapsulation transmission system. Due to its unique advantages, the microcapsule microencapsulated controlled release transmission system has become a promising controlled release transmission system. Compared with enzymes in nature, artificial mimic enzymes should have the advantages of high efficiency of natural enzymes, good stability, easy recycling, easy separation and other excellent properties not possessed by natural enzymes. Enrichment and separation of liposomes. In the preparation process of liposome, a large amount of organic solvent is generally used, and the residual organic solvent poses a threat to human health; when the concentration of bile salt is 0.5 mg/mL, the micelleization rate of the functional factor is significantly increased. The micellization rate of the functional factor was reduced when no trypsin was added compared with 0.3 mg/mL trypsin. On this basis, the membrane can be further modified, such as the immobilization of biomolecules, and it is expected to develop a biosensor with higher sensitivity and better anti-interference.

Nanocarriers can be broadly classified into organic, inorganic, or a combination of both. Organic nanocarriers consist of polymer nanoparticles and lipid nanoparticles, such as liposomes, nanoemulsions (such as micelles and reverse micelles), dendrimers, and carbon-based nanocarriers (such as fullerenes and carbon nanotubes)). The inorganic nanocarriers consist of metal nanostructures such as quantum dots (Figure 1).



(A)Micelle (B)Polymer nanoparticles

Fig.1. Schematic diagrams of two nanocarriers

A certain amount of acetate anti-digestive starch was dissolved in suitable organic solvents to prepare a solution with 3% acetate anti-digestive starch concentration. Glycerol triacetate, which accounts for 25% of the dry weight of acetate anti-digestive starch, was added and stirred by magnetic force for 7 hours. Proteins are relatively large in volume, and their molecular weights are generally between several thousand Da and several million Da. In order to form stable recognition sites, small molecule imprinting polymers have high crosslinking degree and dense structure. In general, the targeting of liposomes is mainly concentrated in the organs rich in reticular endothelial cells. If we want to treat other organs and tissues, the targeting of liposomes is not obvious. Some liposomes have complex preparation process and high energy consumption. Functional factors are highly prone to isomerization or degradation under the action of light, heat, oxygen, acid, metal oxygen promoters and surfactants, so these disadvantages are controlled as much as possible during each experiment. This has promoted high-throughput studies of protein kinases to some extent. However, antibody recognition still has certain limitations. For example, the antigenic determinants of anti-silk and threonine phosphorylated antibodies are small, and the binding sites of antigen-antigens are greatly hindered. It is used in the column and its specific adsorption capacity for the template protein is changed after a sharp test. The results show that the molecularly

imprinted gel prepared by using acrylamide as a functional monomer has certain specific recognition ability for the target protein.

Because liquid crystals have a nanoporous structure, which can dissolve hydrophobic, hydrophilic and amphiphilic molecules, and have a series of characteristics such as biodegradability and digestibility through simple enzyme action, they can be applied to solubility in food matrices. Controlled release of biologically active components. The whey protein-alginate can emulsify 25% to 35% of riboflavin to form a stable riboflavin emulsion. The slow release process of riboflavin emulsion was studied by in vitro simulation experiments. As the storage time increases, the leakage of functional factors gradually increases. At the same storage time, the greater the weight gain of the acetate anti-digestive starch film coating, the lower the leakage of functional factors. It can specifically bind phosphotyrosine residues of receptor tyrosine kinase, and recognize 4 to 6 amino acid residues at C terminal to form polyprotein complexes. It can not only solubilize oil-soluble substances, solubilize them in bilayer membranes, but also carry water-soluble substances and encapsulate them in micro-aqueous phase. The hydrolysis of whey protein at the riboflavin interface was controlled by steric hindrance, thus delaying the release of riboflavin. In addition, because of the high molecular weight of protein, it is easy to be embedded in the polymer and difficult to elute, which affects the adsorption and separation of protein.

3. Result Analysis and Discussion

As a food carrier, the microemulsion will be affected by salinity and P H after entering the human body. Therefore, the influence of salinity and P H on microemulsion should also be considered. The sensitivity of microemulsions prepared from nonionic surfactants to salinity is generally much lower than that of ionic surfactants. After thermal denaturation, whey protein has good emulsification stability and can be quickly adsorbed to the oil-water interface. The addition of Ca2+ can cross-link protein molecules and improve the emulsifying stability of protein. This is due to the interaction of lactic acid bacteria, acid and water in yogurt with starch molecules in acetate-resistant starch film. It is innovative and a new development direction to construct biosensors using novel nanomaterials as electrode preparation materials. The SH2 domain contained in one protein directly interacts with the phosphorylated tyrosine residue on another protein to form a protein heteromeric complex, which is regulated by phosphorylation or dephosphorylation of tyrosine residues, and finally Signal transmission. Since acrylamide is capable of providing a multiple amino bond as a binding site for a template protein, it was selected as a functional monomer. The amino and carboxyl groups of the template protein itself are linked to the amide group on the AAm via an amino bond to be immobilized on the polymer network. When the brine is continuously added, the mixing of the substances is uniform, and the adsorption of the surfactant is enhanced, and the solution begins to spontaneously form a microemulsion structure. However, overall, the microemulsion area is reduced by a small margin.

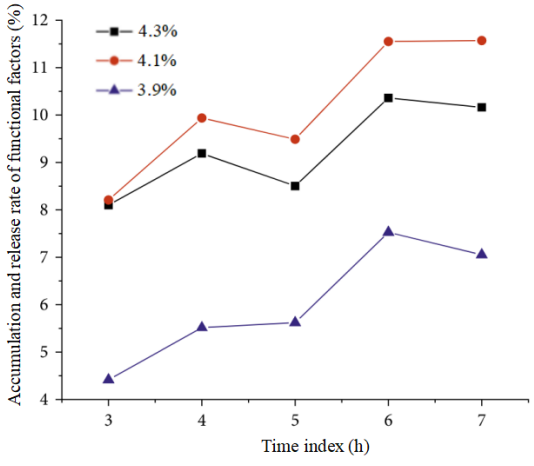


Fig.2. Release of acetate-resistant digestive starch film coated pellets with different coating thickness in simulating human digestive tract

At the same storage time, the cumulative release rate of functional factors in the gastrointestinal tract gradually decreases as the thickness of the coating increases. Figure 2 shows the release of acetate-coated starch pellets with different coating thickness in simulated human digestive tract after yoghurt storage for different time.

The active protein/peptide mainly controls the growth, development, immune regulation and metabolism of the human body. It is in an equilibrium state in the human body. If the active protein/peptide is reduced, the function of the human body changes significantly. With the prolongation of storage time, the degradation degree of acetate anti-digested starch film gradually increases, and the starch molecular chain rearranges, resulting in increased rigidity of acetate anti-digested starch film and easy embrittlement. Due to the large steric hindrance of the phosphate group and the two negative charges, the phosphorylated polypeptide has undergone significant changes in chargeability and enzymatic properties. Among them, itaconic acid is easily polymerized, and the polymer can provide a side chain carboxyl group having a high hydrophilicity and capable of forming an amino bond with a related group. When a double continuous structure is formed, that is, the phase change occurs. Because the double continuous phase is the structure of water and oil as a continuous phase at the same time, electrical conductivity has a distinct mutation, so it is often used to indicate the phase transition of microemulsion. The longer the yoghurt is stored, the larger the release of functional factors is when the pellets coated with acetate anti-digestive starch film with the same coating thickness enter the human digestive tract environment. Therefore, proteins can be used to encapsulate unsaturated fatty acids to protect them.

In addition, due to the abundant characteristic sequence types of protein kinases, some recognition principles mentioned above will be limited when applied to different kinases. Food protein has good interfacial properties. It forms a protective film on the surface of oil droplets and electrostatic repulsion between oil droplets. It also has certain antioxidant properties. At this point, the concentration of microemulsion increases, resulting in frequent viscous collisions between droplets due to mutual attraction. The direct result of viscous collision leads to the formation of many narrow and small water pipes or passages in the oil continuous phase, and counter ions can move through these narrow channels, so that the conductivity of the dissolving liquid increases rapidly. As the running time increases, the crack on the surface of the pellet becomes larger, but the coating layer on the surface does not loosen. The contact between the pellet core and the surrounding simulated digestive juice is limited, and the release of functional factors is not large. If the substrate polypeptide is a carboxyl-rich (negatively charged) protein kinase, the specificity will be significantly reduced, so it is necessary to develop a more universal recognition mechanism. When the temperature rises and the thermal motion accelerates, the collision between the micelles becomes frequent and the electrical conductivity increases. In the experimental temperature range, the microemulsion conductivity increased linearly, and the microemulsion system was clear and transparent, and no turbidity and other anomalies occurred, indicating that the microemulsion type did not change within this temperature range. When the pellets continue to be immersed in the simulated intestinal fluid and artificial colonic fluid, the degree of damage on the surface of the pellets is increased, and the functional factors in the pellet core are uniformly released.

4. Conclusion

After years of research and development, the functional factor delivery system is favored by people for its excellent properties of protective functional factors. The slow release-control properties of functional factor delivery systems are widely used in pharmaceutical, cosmetic and functional foods. This study investigated the release of functional factors protected by functional protein nanomaterials based on functional nanomaterials and the microscopic morphology of the coating layer on the surface of pellets. By combining the principle of protein kinase specific recognition with the signal conversion and amplification methods based on nanomaterials, a series of new principles and methods for kinase analysis have been developed, which greatly improves the analytical efficiency of kinase sensing. After storage in yogurt for different time, the surface morphology changes of pellets with different coating thickness in simulated digestive tract were

consistent with their release. Therefore, the development of continuous detection methods of kinase activity will be one of the basic goals of the future development of kinase nanosensor technology. The results of this study provide a new way to improve the physiological function of functional factors in liquid food system, and also provide a new idea for the high value-added utilization of starch.

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