Polymeric Industry Incubation Synthesis and Application from the Perspective of Collaborative Innovation

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Abstract: Collaborative innovation not only is a collaborative platform and optimization inside and outside the school, but also emphasizes the incubation and application of scientific and technological innovation resources within the school. The article first describes the innovative production of collaborative innovation platforms and discusses the connotation of industrial incubation in colleges and universities; then accurately analyzes the path of synthesis and application of two typical materials in the polymer direction: sodium alginate and feather keratin composite fiber, acrylate emulsion, and explains the two materials in combination with the collaborative innovation platform, large-scale production and market value. The research believes that building a public platform for scientific and technological innovation based on collaborative innovation and carrying out the incubation and synthesis of high-molecular fiber materials is an effective high-tech market-oriented production model. It can absorb the participation of non-teaching scientific research personnel in scientific research teams, and facilitate the development of related disciplines. Academic exchanges.

1. Introduction
China's “13th Five-Year Plan” and “National Innovation Development Program” emphasize the important role of collaborative innovation in achieving innovation-driven countries and enhance collaborative innovation to the national strategic level. At present, the collaborative innovation system is mainly composed of enterprise R&D institutions, universities, research institutes, governments and intermediary organizations. It will become an important carrier for knowledge creation, knowledge dissemination and knowledge application, providing national innovation and industry innovation. Strong support and motivation. Colleges and universities are an important fulcrum in the national innovation network system. Based on this, try to build a public platform for scientific and technological innovation in universities from the perspective of collaborative innovation.

2. Literature review

2.1 Collaborative innovation platform
Ansoff[1] defined the concept of synergy for the first time, and believed that synergy is the process of
creating value sharing among the main resources of innovation. On this basis, Haken\cite{2} pointed out that collaboration is a complex system with multiple interconnected and interacting subsystems. The birth of collaborative innovation concept benefits from the blurring of boundaries in innovation and R&D activities, that is, the open innovation model proposed by Chesbrough\cite{3}, which means that an organization can simultaneously obtain valuable innovation resources from its external and internal sources, and take advantage of the process of using your own and others to innovate resources. Under the collaborative innovation paradigm, organizations have common goals, form knowledge sharing mechanisms internally, form multi-faceted exchanges, diversify and collaborate, and achieve maximum integration of innovation elements.

2.2 Preparation status of sodium alginate and feather keratin composite fiber
The discarded feathers are not fully utilized because the feather keratin molecular structure contains high-density disulfide bonds, because the presence of disulfide bonds makes the feather protein difficult to dissolve in various solvents, and keratin derived from different places for proteases The degree of hydrolysis is different. Therefore, The development and application of keratin is mainly to solve the problem of opening the disulfide bond in keratin molecules.

2.3 Acrylate emulsion status
The emulsion polymerization of acrylates and other vinyl ester monomers can provide acrylate copolymer emulsions, which improve the aging resistance\cite{5}, film formation, oil resistance, acid and alkali resistance\cite{6}, etc. Great improvement. However, the acrylate emulsion has poor water resistance, and it is brittle when the temperature is low. When the temperature is high, it will become sticky and lose strength. Therefore, the modification of the acrylate emulsion to prepare the acrylate emulsion with special properties has become the key point of research.

3. Current status of preparation and research and innovative collaborative production inputs

3.1 Preparation status of sodium alginate and feather keratin composite fiber
Oxidation method combined with acid-base method to extract keratin in feather, prepare phase change material, feather protein and sodium alginate are added to phase change material for blending and spinning.

3.2 Preparation status of acrylate emulsion
First, the preparation of the pre-emulsion; secondly, preparing the bottom of the reaction vessel; then, the pre-emulsion and the initiator are added dropwise in the opposite direction; finally, ADH is added and neutralized. After the completion of the reaction, the solid content, the conversion ratio, the gel fraction, the emulsion viscosity, the emulsion coating film, and the adhesion can be measured.

3.3 Innovative collaborative production
Whether it is about the preparation of sodium alginate and feather keratin composite fibers, or the polymerization of acrylate emulsions, there are researches on universities and enterprises. From the perspective of innovative collaborative production, it is obvious that universities can provide more innovative ideas and technologies for enterprises. Enterprises can provide external technical personnel and financial support for universities. Under this mechanism, buyers have low bargaining power and are subject to Substitutes and potential entrants are less threatening, and there is no doubt that the two sides have an advantage when competing with similar industries.

4. Industry incubation and scale production

4.1 Industry incubation platform
Collaborative innovation based on the industry incubation platform refers to the organic cooperation
between the university and the enterprise, through the synergy to improve their respective innovation capabilities, to maximize the potential of innovation in the collaborative mode by means of resource integration, and accelerate the innovation activities. Carry out, resulting in synergistic innovation effects of mutual benefit and win-win. The following is a collaborative innovation model of the industry incubation platform combined with the two, the university provides intellectual support, and the company provides support for non-teaching research departments and related resources.

Figure 1. Collaborative Innovation Pattern

4.2 Scale production plan

According to the relationship between scale production and experience curve effect, the school can use its own research and development advantages to increase the learning economy. The production of enterprises has economies of scale compared with schools. When the two companies combine organic products to develop new products, they can make new products in the life cycle. It has a large cost advantage.

On the basis of the industry incubation platform, enterprises can make up for the shortage of large-scale production in colleges and universities. It is undeniable that universities can conduct effective high-tech research and development because of their own research and development advantages, but the limited funds and resources of colleges and universities limit the promotion and application of their research and development results in the market. By establishing an industry incubation platform, the university provides teachers with practical and practical training, and can cultivate more high-tech applied talents that the society needs, and at the same time improve the employability of college students.

In the scale production, the organizational structure of the enterprise is shown in Figure 2. The schematic diagram here is simplified. The administrative refers to the other functional departments of the company except the scientific research accident. It can be seen from the figure that R&D personnel of different research directions can provide unified services for different projects, non-teaching and scientific research personnel participate in scientific research teams, and horizontal thinking and production planning can be combined. Enterprises can reduce operating costs and accelerate capital flow; In addition, the company's docking department can continuously enhance the market vitality, meet customer needs, improve management level and the company's own competitiveness. In addition, for the market, it is not used, but the incubation platform has been developed to prevent technology loss and waste of resources.

Figure 2. Schematic diagram of matrix organization
5. Conclusion

5.1 Explanation of experimental results

5.1.1 Sodium alginate and feather keratin composite fiber
The sodium alginate/keratin blend solution with different pH is configured, and the blend solutions of PH=6, 7, 8, 9, and 10 are respectively arranged, and the spinning is stopped under the condition that the concentration of the coagulation bath is 5% and the residence time is the same. The yarn was tested for single fiber fracture. The results obtained can be seen in Fig. 3. At the same temperature, the breaking strength of the blended fiber and the increase of the pH of the blending solution first decrease and then increase. The fiber breaking strength did not change much with the change of the pH of the blending solution.

![Figure 3. Effect of PH on the fracture strength of non-phase-change blended fibers](image)

5.1.2Acrylate emulsion
It can be seen from Table 1 that when the total amount of monomers is constant, the addition amount of functional monomer MAA is increased, and the emulsion performance is greatly affected. As the amount of MAA added increases, the conversion rate of the monomer increases first. After the downward trend, the solid content of the emulsion also changes. The solid content directly affects the viscosity of the emulsion, so the viscosity of the emulsion increases as the solid content increases, and the performance of the emulsion is improved. In summary, the functional monomer The ratio of MAA is 5%, which is the best ratio.

| Functional monomer dosage/% | Conversion rate/% | Viscosity/mPa s |
|---------------------------|------------------|-----------------|
| 3                         | 92.36            | 76.4            |
| 4                         | 95.52            | 103.5           |
| 5                         | 98.76            | 152.3           |
| 6                         | 94.67            | 136.6           |
| 7                         | 93.21            | 125.4           |
5.2 Conclusions and future research directions

5.2.1 Sodium alginate and feather keratin composite fiber: The breaking strength of sodium alginate/keratin phase change blend fiber decreases firstly with the content of PH in the blending solution, then increases and then decreases, thereby judging the breaking strength of the fiber. The pH of the solution does not matter much. In the future, the school will collaborate with the enterprise personnel to further explore the factors affecting the fracture strength of the fiber.

5.2.2 Acrylate emulsion: The performance of the emulsion film was tested. The application of room temperature crosslinkable acrylate emulsion was studied. The conclusions obtained are as follows: using pre-emulsified-semi-continuous emulsion polymerization method, 82 ° C as the reaction temperature, the stirring speed is 300~500rpm, the emulsifier is used with CO-436/OP-10, the emulsifier is not 2.7, and the initiator is ammonium persulfate, which is the best when it accounts for 0.53% of the monomer. When the soft and hard monomer ratio is 3:4, the emulsion polymerization system is the most stable, and the obtained emulsion has the best performance. In the future, it will further play the role of enterprises, and try to involve non-teaching scientific research personnel in the research team and conduct interdisciplinary exchanges to provide more innovative ideas.

References

[1] Ansoff H I. Corporate strategy: An analytic approach to business policy for growth and expansion [M]. New York: Megraw-hill, 1965: 15-33
[2] Haken H. Synergetics: An introduction: nonequilibrium phase transitions and self-organization in physics chemistry and biology [M]. Berlin, Germany: Springer, 1983
[3] Chesbrough H. The goverance and performance of Xerox's technology spin-off companies I]. Research Policy, 2003 32(3):403-421
[4] Hu Xinhua. Extraction of Feather Protein. Leather Science and Engineering, 1997, 7(13): 5
[5] Li Z R, Fu K J, Wang L J, et al. Synthesis of a novel perfluorinated acrylate copolymer containing hydroxyethyl sulfone as crosslinking group and its application on cotton fabrics[J]. Journal of Materials Processing Technology,2008,205(3):243-248.
[6] He J Y, Zhang Z L, Kristiansen H. Compression properties of individual micron-sized acrylic particles[J]. Materials Letters,2009,63(20):1696-1698.