

Ershi Qi
Jiang Shen
Runliang Dou *Editors*

Proceedings of 2013
4th International Asia
Conference on
Industrial Engineering
and Management
Innovation (IEMI2013)

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Preface

Established in June 1990, the Chinese Industrial Engineering Institution (CIEI), CMES, is the first and unique national institution in the field of industrial engineering recognized by China Association of Science and Technology.

At present, CIEI announces an enormous number of experts, scholars and sub-societies. During the past 20 years, CIEI held dozens of domestic and international academic conferences, including quite a number of Hong Kong, Macao and cross-Strait industrial engineering forums and seminars. Sticking to the philosophy of “serving the country, serving the society, and serving the members”, CIEI has established profound cooperation with institutes and organizations from USA, England, Russia, Japan, Korea, Hong Kong, Taiwan and other countries or areas. CIEI currently possesses more than 20 local Institutions of Industrial Engineering, over 6,000 individual members and 136 corporate members.

The most distinguished characteristic of Academic Activities is The International Conference on Industrial Engineering and Engineering Management annually sponsored by CIEI. Being the most important international academic conference, it proves to be an advantageous platform for experts, scholars and business people in this area to exchange their theoretical and practical research views and results. Another second distinguished characteristic is The Enterprise Summit on the Application and Practice of Industrial Engineering held yearly. It aims to boost practical application of industrial engineering in production and to speed up the enterprise growth. Additionally, the Industrial Engineer Certification Working Group has been established to help novices to better and quicker adapt to the practice of industrial engineering; 24 training centers have also been authorized so that thousands of candidates are granted the license of “Qualified Industrial Engineer”.

The 4th International Asia Conference on Industrial Engineering and Management Innovation, held in Taiwan University, is another major international conference sponsored by CIEI. In the conference, some excellent scholars and specialists, both from home and abroad, as Keynote Speakers are to share their glory of achievement on scientific research and application in Industrial Engineering and Management Innovation. In the meanwhile, some parallel sessions are held in order that the authors can offer their opinions on the Theory and Technology

of Industrial Engineering, Assistive Technology of Industrial Engineering and Management System Innovation. In a word, this conference aims to establish a platform for exchanging their theoretical research, achievement exhibition and practical exploration, to promote the development and application of theory and technology of this area in colleges and industries. We hope to promote the extensive cooperation and exchanges among the authors on the conference.

Finally, we would like to extend our sincerest thanks to the Department of Industrial Engineering, Taiwan University, for holding such an excellent event.

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Tianjin, People's Republic of China
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Part I
Advanced Design and Manufacturing

Preparation of a Kind of Honey Effervescent Tablets

Ya-hui Zhang and Ze-yuan Huang

Abstract The aim of the research is to develop a kind of honey effervescent tablets. With honey power and pregelatinized starch as main raw materials, the matching accessories are chosen by the orthogonal test to select the production technology of the honey effervescent tablets. The optimized formula of the honey effervescent tablets is honey power 60 %, pregelatinized starch 15.5 %, citric acid 11.7 %, sodium bicarbonate 8.3 %, sodium cyclamate 2.0 %, PEG6000 2.5 %. The honey effervescent tablets prepared by this method which is simple and feasible, have stable quality and good taste, meet pharmacopeia standards, disintegrate rapidly and are easy to take.

Keywords Disintegrate • Effervescent tablets • Honey

1 Introduction

Since ancient times, honey is considered as a kind of very good food and drug and there are a lot of records in the ancient literature. Honey is composed of fructose and glucose and other sugars, easily absorbed by the body. In addition to containing sugar, honey also contains a variety of nutrients beneficial in normal function of cells and tissues, and organs. Honey has rich nutrition and great heat, with per kg mature heat yield about 12,560 joule. Honey has no fat, is perfect health tonic and is very suitable for the elderly, children, maternity and the sickness [1].

As a new dosage form in recent years, effervescent tablets are convenient to carry, distribute quickly in the water, with effective components easy to absorption and high bioavailability advantages. Effervescent tablets have the characteristics of both

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the solid preparation and the liquid preparation, have broad market prospects in pharmaceuticals and food industry. First of all, in addition to the main agents and excipients in the production of effervescent tablets, you can also add flavorings, sweeteners, coloring agents and excipients, etc., to improve the food flavor and develop a series of different flavors of effervescence food. Secondly, the effervescent has special disintegrants—effervescent disintegrants, disintegrate rapidly in cold water, help absorption and easier to take and carry than other formulations. The effervescent tablets form the food with delicious flavor and taste, instant ready to drink, especially to cater to the young people who love the new, extraordinary and special, has obvious advantages in the field of children and adolescents [2]. The honey effervescent tablets using honey as raw material made by this paper retain the nutrients and flavor of honey, rapid disintegration, good taste, convenient use and convenient carrying, long shelf life, become hot and cold can of carbonated beverage after dissolving, greatly increase the drinking interest.

2 Materials and Methods

2.1 Materials

Honey power (Hubei wuhan small bee food company), sodium cyclamate (Guangdong huasheng food chemical company in guangzhou branch), sodium bicarbonate (Beijing the odd century chemical trading company), citric acid (Hubei galactic chemical manufacturing company), pregelatinized starch (Tianjin peak starch development company), etc., are consumption level; absolute ethyl alcohol is of analytical grade, PEG6000 (Suzhou beautiful alum chemical industry trade company) is for medicinal level.

2.2 Instruments

TDP model sheet stamping machine (Shanghai tensho health station pharmaceutical machinery company), FA2104N analytical balance (Beijing ze xiang yongxing technology company), GZX-9070 mbe digital display blast drying oven (GZX-9070 mbe digital display blast drying oven), 78X-Z type tablet four eyes with meter (Shanghai yellow sea drug test instrument factory), YK-60 type granulator (Hunan ensure pharmaceutical machinery factory), WF130-30 universal mill (Changzhou music star drying equipment company).

Table 1 Honey effervescent beverage scoring reference standard

Color (20 score)	Smell (30 score)	Taste (30 score)	Posture (20 score)
Lvory without impurities (18–20)	Honey unique fragrance, rich (20–30)	Has the unique taste of honey (27–30)	Clear, without impurities, no separation (18–20)
Pale ivory without impurities (16–18)	Have fragrance, rich (24–27)	Has the unique taste of honey, suitable sweet and sour (24–27)	Without impurities, no separation (16–18)
Pale white, slightly impurity (below 16)	Have fragrance, light (below 24)	Honey taste is light, not palatable (below 24)	Light turbidity, impurity (below 16)

Determination of the quality indicators. Weight determination [5], according to inspection in accordance with the Chinese Pharmacopoeia 2005 edition an appendix I tablet weight difference. The disintegration test [5], check according to the Chinese Pharmacopoeia 2005 version of under disintegration effervescent tablets according to law. The measurement of pH [5], take three samples, plus 50 °C 100 mL water to dissolve, after 1 min, measure pH value according to the determination method of Chinese Pharmacopoeia 2005 version of an appendix VII. The amount of CO₂ in the effervescent [6], weigh the conical flask and 100 mL water and ten pieces of sample using weight precision loss method, record the total. The sample is added to the water, shaking with 20 min again precisely weigh the conical flask until no bubbles emerge, record weight, the reducing weight is the amount of CO₂.

Sensory evaluation method. Using sensory evaluation method, use respectively by color, smell, taste, posture as the target of sensory evaluation [7] (Table 1).

3 Results and Discussions

3.1 Single Factor Experiment Done to Achieve Primary Influencing Factors of the Preparation Process

The determination of adhesive. Using absolute ethyl alcohol as adhesive, particle is not easy to agglomerate and dry quickly, products dissolve rapidly. Therefore, using absolute ethyl alcohol as adhesive, its effect is induced by the viscous and wetting tablet.

The determination of lubricant. Particles must be added lubricants before tableting with the purpose of avoiding weight variation, the sticking difficulties during the industrialized production of tablet, and maintaining tablets's smooth appearance which is convenient to tablet smoothly [8]. The referenceshows that the lubricant

Table 2 Test factors level table

Levels	Factors			
	A (%)	B (%)	C (%)	D (%)
1	15	55	1.5	2.0
2	20	60	2.0	2.5
3	25	65	2.5	3.0

PEG6000 has good lubricity, viscous resistance and water solubility [9]. So we choose PEG6000 as the lubricant, the single factor experiment was conducted to determine the amount of polyethylene glycol 2 %.

The determination of sweeteners. In order to improve the taste of honey effervescent tablets, we should choose the appropriate sweetener to eliminate pungent taste sour and to reach the appropriate sweet-sour ratio [10]. In the choice of the sweetener cyclamate, sodium cyclamate is a kind of common sweeteners, the sweetness is 50 times of sucrose. Sodium cyclamate belongs to the non-nutritive sweeteners, is generally not involved in glucose metabolism, but also can not be biodegraded, is suitable for patients with diabetes and obesity. It does not produce dental caries, its sweetener tastes better than the general sweeteners, and the single factor experiment was conducted to determine the adding amount is 2.5 %.

The determination of effervescent agent. Effervescent disintegrating agent is a kind of acid-base system that will produce carbon dioxide gas disintegration when mixed with water. Since citric acid taste mellow, soft, refreshing, delicious, we use citric acid as acid source. All things taken into consideration, choose citric acid and sodium bicarbonate as effervescent disintegrating agent [11]. In practical applications, the acid dosage should be larger than the amount of chemical reaction theory to ensure carbonate reaction completely and weak acid of the effervescent tablets, so as to change the effervescent tablets taste sense [10]. Using single factor test, the pH value and taste for evaluation, results show that, when the citric acid and sodium bicarbonate mass ratio was 1.4:1, the pH value is 4.5, the taste is best.

Orthogonal test to optimize the preparation process. According to the results of single factor test, screen factor A (effervescent disintegrating agent), B (honey powder dosage), C (PEG6000 content), D (sodium cyclamate content) and carry out orthogonal test, anhydrous ethanol added according to requirements, filler pregelatinized starch to maintain weight [12], evaluate the quality according to the sensory index score of finished products (Table 2).

The optimal level combination of flavor is $A_2B_2C_3D_1$, Factor D (sodium cyclamate content) as the least significant factors, its impact on flavor is small. Through calculation, the main formula for honey effervescents is honey power 60 %, pregelatinized starch 15.5 %, citric acid 11.7 %, sodium bicarbonate 8.3 %, sodium cyclamate 2.0 %, PEG6000 2.5 %. The weight of single tablet prepared by this recipe is about 1.50 g and the tablet releases a large amount of gas when solubling in 100 mL water, form transparent and white milky drinks which has honey fragrance, tasty sour and sweet (Table 3).

Table 3 Orthogonal test results and analysis

Serial number	A effervescent disintegrants (%)	B honey power (%)	C PEG6000 (%)	D sodium cyclamate (%)	Sensory score
1	1	1	1	1	60
2	1	2	2	2	73
3	1	3	3	3	75
4	2	1	2	3	72
5	2	2	3	1	86
6	2	3	1	2	79
7	3	1	3	2	74
8	3	2	1	3	76
9	3	3	2	1	78
K ₁	208	206	215	224	
K ₂	237	235	223	226	
K ₃	228	232	235	223	
k ₁	69.33	68.67	71.37	74.67	
k ₂	79.00	78.33	74.33	75.33	
k ₃	76.00	77.33	78.33	74.33	
R	9.67	9.67	6.67	1.00	

3.2 Verification Test

Select three batches preferably by orthogonal test results, the tablet disintegration time were 120, 130, 140 s. The effervescent tablet has sweet and sour taste, refreshing and aromatic taste, blister fast, has smooth appearance, uniform color and honey flavor. The experiment results show that this technological process is stable and feasible.

3.3 The Quality of Finished Products

Product color is white; morphology is round, the surface is smooth and appearance is neat; the aroma and taste has a little honey aroma, sweet and sour, soft taste; moderate hardness.

4 Conclusion

Through the above research obtained, the best formula of honey effervescent tablets is honey power 60 %, pregelatinized starch 15.5 %, citric acid 11.7 %, sodium bicarbonate 8.3 %, sodium cyclamate 2.0 %, PEG6000 2.5 %. The effervescent tablets prepared disintegrate rapidly, its hardness and foaming capacity are in line

with the effervescent requirements, they have good appearance, uniform color, moderate hardness, disintegrate rapidly in cold water, good taste, suitable for all types of people, especially children and sickness.

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