嘉南藥理科技大學專題研究計畫成果報告

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計畫主持人：許立人

共同主持人：林恆弘

計畫參與人員：王博駿

執行單位：嘉南藥理科技大學 藥學系

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嘉南藥理科技大學專題研究計畫成果報告

含茄紅素之固體製劑研發（1）圓粒劑型

Investigation of solid products for lycopene (1) pellet dosage forms

計畫編號：CNPH-92-01
執行期限：92 年 1 月 1 日至 92 年 12 月 31 日
主持人：許立人　嘉南藥理科技大學 藥學系
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一、中文摘要

現今的消費者使用乾燥製品的情形相當普遍，就經濟上與方便性而言，其具有可增加製品的架貯期、減少包裝、降低價格與改善操作特性等優點。在本研究中，嘗試使用不同的乾燥技術如凍晶乾燥、熱風乾燥及真空乾燥等方法將蕃茄糊製成脫水的粉末；當蕃茄糊的含水量經乾燥而下降時，其硬度亦隨之增加，藉由粉碎或研磨即可成為粉體。然而，由於非晶形粉體中含糖量偏高的緣故，粉體吸濕、結塊與不良性質等問題也應運而生，實驗結果顯示，乾燥或脫水的方法與條件並不能獲得可作長期貯存之固體製品，如果乾燥的粉體不使用適當的包裝進行防潮保護，則應在蕃茄糊的乾燥過程中添加進少量合適的賦形劑來安定最終的粉體，由此所獲得的製品在無特殊包裝之下仍能維持味道、顏色、氣味不變達數月之久。

關鍵詞：茄紅素，吸濕性，固體製劑，粉體，圓粒

Abstract

Dry products have a high level of popularity with today's consumers. Dry mixes are economical and convenient with increased shelf-life, reduced packaging, decreased cost and improved handling properties. In this study, dehydrated powders from tomato pulp made by various drying techniques include freeze-drying, hot air drying and vacuum drying. When tomato pulp is dried to low moisture, so that they are hard, they can be pounded or milled to a powder. However, the hygroscopicity, caking and all the problems associated with stickiness final powder are mainly due to more sugar being present in an amorphous state. The results show that the drying or dehydration method and conditions did not offer proper solid products for long terms of storage. If the drying powder will not be protected by suitable packaging from the humidity, small amounts of appropriate excipients should be added to tomato pulp during drying process to enhance the stability of final powder. The resulted

dried products will keep without special packaging for several months and the senses（taste, color, odor etc.）remain unchanged.

Keywords: Lycopene, Hygroscopicity, solid product, powder, pellet

二、Introduction

Lycopene, a bioactive carotenoid without provitamin-A activity, is principally responsible for the characteristic deep-red color of ripe tomato fruits and tomato products. It has attracted attention due to its biological and physicochemical properties, especially related to its effects as a natural antioxidant. Although it has no provitamin A activity, lycopene does exhibit a physical quenching rate constant with singlet oxygen almost twice as high as that of beta-carotene. This makes its presence in the diet of considerable interest. Increasing clinical evidence supports the role of lycopene as a micronutrient with important health benefits, because it appears to provide protection against a broad range of epithelial cancers. Serum and tissue lycopene levels have also been inversely related with the chronic disease risk. [1-3] Although the antioxidant properties of lycopene are thought to be primarily responsible for its beneficial properties, evidence is accumulating to suggest other mechanisms such as modulation of intercellular gap junction communication, hormonal and immune system and metabolic pathways may also be involved. [4] Tomatoes and related tomato products are the major source of lycopene compounds, and are also considered an important source of carotenoids in the human diet. Undesirable degradation of lycopene not only affects the sensory quality of the final products, but also the health benefit of tomato-based foods for the human body. [5] Lycopene content of tomatoes remained unchanged during the multistep processing operations for the production of juice or paste and remained stable for up to 12 months of storage at ambient temperature. Moreover, lycopene is fat-soluble, including a small amount of fat in a formulation can help increase its bioavailablility. [6] It is well known that putting tomato ingredients in wet systems where tomato color, flavor and texture are desirable is generally not a problem, but dry systems might be another story. For instance, including tomato powder in a low-moisture cracker can be a

challenge because of its attendant hygroscopicity. Thus, the purpose of this study is desired to obtain a less hygroscopicity solid product by commonly drying pasta sauces of the extract with less quantity of added auxiliary agents compared with the conventional obtained botanical extract composition of prior works.

三、Results and discussion

The formulation used in the experiments is shown in Table 1. The appropriate excipients to be mixed are directly combined with semi-solid tomato pulp in exactly the correct proportion. The paste is then dried by various drying techniques include freeze-drying, hot air drying and vacuum drying. For various drying techniques, physical and structural changes occur during a dehydration process. Freeze-drying and vacuum drying result in bright red product with minimal shrinkage. However, at present there is no low-cost equipment available to our knowledge. Hot air drying is faster process but results in a dense dark red product with a hard outer crust and slower water adsorption properties.

When the dried powder of tomato pulp without adding auxiliary agents is obtained with low moisture content, it is hard. Re-hydration is relatively slow. Provide that the humidity rises, the product will go moldy. The results indicate that the drying or dehydration method and conditions did not directly offer proper solid products of tomato botanical extract composition for long terms of storage. To protect the drying powder from the humidity, as far as small amounts of appropriate excipients was added to tomato pulp during drying process to enhance the stability of final powder. It can be seen that the resulted dried products would keep without special packaging for several months and the senses（taste, color, odor etc.）remain unchanged.

Table 1. Formulae of tomato solid product

Composition	Amount ratio (%, W/W)
Tomato pulp	83.0~97.1
Food fiber	2.5~2.9
Disintegrants	0~2.5
Antiadhesives	0~7.5
Lubricants	0~2.5
Total	100

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五、References:

1. Shi J, Le Maguer M., Lycopene in tomatoes: chemical and physical properties affected by food processing. *Crit Rev Biotechnol.* 2000;20 (4):293-334.
2. Agarwal A, Shen H, Agarwal S, Rao AV., Lycopene Content of Tomato Products: Its Stability, Bioavailability and In Vivo Antioxidant Properties. *J Med Food.* 2001 Spring;4(1):9-15.
3. Rao AV, Agarwal S., Role of antioxidant lycopene in cancer and heart disease. *J Am Coll Nutr.* 2000 Oct;19(5):563-9.
4. Watzl B, Bub A, Brandstetter BR, Rechkemmer G., Modulation of human T-lymphocyte functions by the consumption of carotenoid-rich vegetables. *Br J Nutr.* 1999 Nov;82 (5):383-9.
5. Nelson JL, Bernstein PS, Schmidt MC, Von Tress MS, Askew EW., Dietary modification and moderate antioxidant supplementation differentially affect serum carotenoids, antioxidant levels and markers of oxidative stress in older humans. *J Nutr.* 2003 Oct;133 (10):3117-23.
6. Shi J, Le Maguer M., Lycopene in tomatoes: chemical and physical properties affected by food processing. *Crit Rev Food Sci Nutr.* 2000 Jan;40(1):1-42.

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