Short Communications

Usage of Chitosan in Thai Pharmaceutical and Cosmetic Industries

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Abstract

Chitosan has varieties of applications in both pharmaceutical and cosmetic products. To explore the situation of chitosan awareness and usage in Thailand is an essential information for product development from chitosan. Entrepreneurs or their representatives from GMP certified pharmaceutical and cosmetic manufacturers were interviewed during June 2007 to February 2008. One hundred and five from 225 factories (47%) participated in this study. Product awareness was very high (93.3%). For pharmaceutical industry, the most familiar applications of chitosan were anti-obesity and cholesterol lowering agent. In cosmetic industry, value of chitosan was perceived as moisturising agent, emollient, and film former. Current usage of chitosan was found in 41.4% of cosmetic industry, mainly for skin care products and 8% of pharmaceutical industry used chitosan mainly for anti-obesity food supplement. Although chitosan use was highly perceived, actual usage was moderate and low in cosmetic industry and pharmaceutical industry, respectively.

Key Words: Chitosan; Cosmetic manufacturer; Pharmaceutical manufacturer

Introduction

Pharmaceutical and cosmetic industries in Thailand are downstream businesses which are dependent on imported raw materials, both active ingredients and excipients. To develop sustainability of these industries, researches and developments for local production of raw material are essential (Kuanpoth, 2007; Umprayn, 2000; Chantarasakul et al., 1999).

Chitosan is a linear copolymer of -(1–4) linked 2-acetamido-2-deoxy-d-glucopyranose and 2-amino-2-deoxy-d-glycopyranose. It is obtained by deacetylation of its parent polymer chitin, a polysaccharide widely distributed in nature (e.g. crustaceans, insects and certain fungi) (Muzzarelli; 1977). Chitosan is one of the interesting substances because of its extensive applications. Various uses of chitosan in pharmaceutical industries were investigated. It was used for a process of direct compression, controlled drug release and drug delivery (Dodane and Vilivalam, 1998; Ilium, 1998). For cosmetic production, emollient and film former were the major roles of chitosan (Lang and Clausen, eds., 1989). Chitosan can be extracted from crustacean shells e.g. shrimp, crab and squid (Muzzarelli; 1977). Fortunately, there is an abundance of natural sources of chitosan from fishery industry waste in Thailand (FAO, 2006). Many Thai researchers

have focused on the development of chitosan production and its applications (Petchsangsaia M., 2011; Khunawattanakula W., 2011; Nunthanid J., 2008; Phaechamud T.,2008). The exploration of the situation of chitosan awareness and chitosan usage in the pharmaceutical and cosmetic industries in Thailand will provide crucial information for product development from chitosan.

Materials and Methods

Population and Sample

Population in this study was 225 GMP certified manufacturers in Thailand. Sample size was calculated by using proportion of chitosan usage 31% (Center of Biotech chitin-chitosan, 2003) ±10% at 0.05 significant level. Total sample size needed for this study was 82 manufacturers.

Data Collection

Constructed interviews were conducted by five trained persons during June 2007 – February 2008. Production managers or research and development (R&D) managers or their representatives were interviewed by phone on general information of factory, main products, respondents' chitosan awareness and perceive value. Chitosan usage of each manufacturer was also in the surveyed topics.

Data Analysis

Obtained data were analyzed employing descriptive statistics; frequency, percentage. Factors of characteristics of manufacturers in both industries which have influence on chitosan perceive value and usage were explored with chi-square statistics.

Results and Discussions

Response Rate and Respondent's Characteristics

Of 255 manufacturers, 105 (46.6%) participated in this study, 76 from pharmaceutical industry and 29 from cosmetic industry. Response rates of pharmaceutical and cosmetic industries were 46% and 48.3%, respectively.

Thirty one point four percents of respondents were R&D managers. One-fourth of all were production managers. The rests were quality control (QC) managers or pharmacists who worked for production or research and development department. Mean of respondents' experiences in the industries were 8.67± 8.43 years.

Chitosan Awareness and Perceived Value

All respondents were asked whether they knew "chitosan" to check for the awareness of the substance. It was found that 93.3% of them knew chitosan. Perceived value of chitosan or basic knowledge about its application of the respondents are reported in Table 1. Anti-obesity agent was the most perceived value of chitosan (50%). The second perceived value was cholesterol lowering agent (25%). Drug delivery application ranked third (20%).

Table 1 Perceived value of chitosan applications (first 10 ranking)

Chitosan applications	% perceived value (n=105)
Anti-obesity agent	49.5
Cholesterol lowering agent	24.8
Drug delivery agent	20.0
Agricultural applications	17.1
Diluent	10.5
Moisturising agent	10.5
Sustain release agent	9.5
Film former	8.6
Coating agent	8.6
Binder	5.7
Wound healing agent	5.7

Chitosan values perceived from pharmaceutical respondents and cosmetic respondents were significantly different, especially the applications as anti-obesity agent, moisturising agent, emollient and film former. Perceived value of chitosan as moisturising agent, emollient and film former from respondents in cosmetic industry is more than those from pharmaceutical area ($p<.0001$, $=0.029$ and <0.0001, respectively). On the other hand, application as an anti-obesity agent was more perceived by respondents from pharmaceutical industry ($p = 0.034$).

Chitosan Usage

Current usage of chitosan was investigated in 105 manufacturers. Of 105, 18 (17.1%) were chitosan current users. Current usage of chitosan was found in 41.4% and 8% of cosmetic industry and of pharmaceutical industry, respectively.

Table 2 Chitosan usage (classified by industry)

Chitosan current usage	Number of manufacturers (%)		
	Pharmaceutical Industry	Cosmetic Industry	Both industries
YES	6 (7.9%)	12 (41.4%)	18 (17.1%)
NO	70 (92.1%)	17 (58.6%)	87 (82.9%)
Total	76 (100%)	29 (100%)	105 (100%)

Most of chitosan users in pharmaceutical industries applied the value of anti-obesity to produce food supplement for weight reduction. The remained pharmaceutical products that used chitosan were blood static pad, disinfectant soap and artificial tear. For cosmetic manufacturers, chitosan was mainly used for skin care cosmetic production, particularly moisturising cream or lotion. Food supplement, hair care and firming gel productions used chitosan as active ingredient or excipients as well.

For those who have never used chitosan for their productions, the major reasons were lacking of scientific supporting data (21%) and their products were simple dosage forms, not advance dosage forms (22.2%). The top 5 reasons were displayed in Table 3.

Table 3 Top 5 reasons of chitosan never users

Reason of chitosan never users	Frequency (n=81) (%)
Produce only simple dosage form	18 (22.2)
Lack of scientific supporting data	17 (21.0)
Lack of knowledge about its applications	8 (9.9)
Strictly follow OEM* contract	6 (7.4)
Lack of information regarding price and application	6 (7.4)

*OEM = Original Equipment Manufacturer

Besides these reasons, a few manufacturers experienced problems from chitosan. The problems were reported as follows:

- Unstable viscosity of cosmetic product when using chitosan as a thickening agent
- Bad smell of glacial acetic acid (from chitosan preparation) in final product.
- More time consuming for gel swelling when compared with other celluloses

Discussions

Although this survey revealed high awareness of chitosan and its values were high perceived, actual usage was moderate and low in cosmetic industry and pharmaceutical industry, respectively. To promote usage of local chitosan production, more information of its applications should be widely provided. Particularly for Thai pharmaceutical industry, value of chitosan was limited as an active ingredient in anti-obesity food supplement

or cholesterol reducing product. The application in drug delivery or sustain release product might be far from the manufacturers' interest because approximately 75% of the pharmaceutical factories did not develop sustain release drug or controlled release drug. Therefore, more information regarding excipient applications e.g. binder, disintegrant, filler, and diluent should be presented to potential users. (Kato Y, 2003) Due to continuing high rising price of lactose, chitosan might has opportunity in diluent market.

Conclusion

The present survey explored chitosan awareness and actual usage from 105 manufacturers. Product awareness was very high (93.3%). For pharmaceutical industry, the most familiar applications of chitosan were anti-obesity, cholesterol lowering agent and drug delivery agent. Chitosan value perceived from pharmaceutical respondents and cosmetic respondents were significantly different. Respondents from cosmetic industry perceived value of chitosan as moisturiser, emollient and film former more than those from pharmaceutical area. On the other hand, anti-obesity effect was more perceived by respondents from pharmaceutical industry. Current usage of chitosan was found in 17.1% of all manufacturers. Cosmetic industry were the major chitosan current users (41.4%) while only 8 % of pharmaceutical industry used chitosan. The main reasons of never users were lacking of scientific supporting data regarding to its applications and their products were simple dosage forms. To promote more usage of chitosan, more information of its applications should be widely available, and attractive price also encourages new chitosan users.

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