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# Effect of Oxalic and Phosphoric acid on Degumming of Rice Bran Oil

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# 수산및 인산이 미강유의 탈검에 미치는 영향

**김선기 · 윤석후 · 김철진 · 최홍식***

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**Abstract**

Solutions of 4,8 and 12% oxalic and 85% phosphoric acid were used for degumming of crude rice bran oil.96.6% of total phosphatides was removed by degumming with either 2*ml* of 85% phosphoric acid or 20*ml* of 4% oxalic acid when added to 1*kg* of crude rice bran oil. Yields after degumming with oxalic and phosphoric acids were 63.6% and 61.0%, respectively.

## Introduction

The crude rice bran oil contains about 2% of phosphatides[1] and degumming is known to be an important process since it plays an important role in quality control of oil products.[2-5] If phosphatides contained in crude oil are not sufficiently removed, the quality deterioration of oil occurs during futher processing.

There have been many assessments to remove phosphatides with respect to degumming agents and conditions for vegetable oils.[2,3,5-9] The data pertaining to the degumming agent and condition for rice bran oil, however, are scarcely available as yet. In this study, attempts were made to select degumming agent suitable for crude rice bran oil and to optimize degumming condition.

## Materials and Methods

### Meterials

Crude rice bran oil was purchased from a local rice bran oil refinery. Acid value and peroxide value of oil were 23.7 and 0.0, respectively. Phosphorus content of crude rice bran oil was 680*ppm* according to AOCS method.[10] All reagents used were of analytical grade unless otherwise specified.

### Degumming Experiment

About 800*g* of crude rice bran oil was poured into 2*l* round bottom flask equipped with a thermometer, stirrer and temperature controllor. Nitrogen gas was purged into oil and purging was continued thoughout the degumming process. Degumming of crude rice bran oil was conducted at 60℃ with continuous agitation. The blade-type stirrer used was Fisher dynamic stirrer and agitation speed was 400*rpm*. Degumming agents such as 4,8 and 12% oxalic acid and 85% phosphoric acid were added at various amount and after 1 min water was added to make the final concentration to 2% water. After 15min agitation, gums are separated from oil by centrifugation at 10,000*g*. Degummed oil was then water-washed at 80℃ with agitation at 200*rpm* and followed by centrifugation at 10,000*g* to obtain degummed and water-washed rice bran oil.

## Results and Discussion

To romove phosphatides in crude rice bran oil, various amounts of 85% phosphoric acid and 4,8 and 12% oxalic acid were added and the results were given in Fig. 1. The phosphatide content designated by phosphorus content reduced to 84*ppm* from 680*ppm* of crude oil after degumming with 4*g* oxalic acid per 1*kg* of crude rice bran oil which was equivalent to 100*ml* of 4% oxalic acid. When degummed by 40*ml* or more of 4% oxalic acid(1.6 *g* oxalic acid/*kg* oil or more), by 26*ml* or more of 8% oxalic acid(2.08*g*

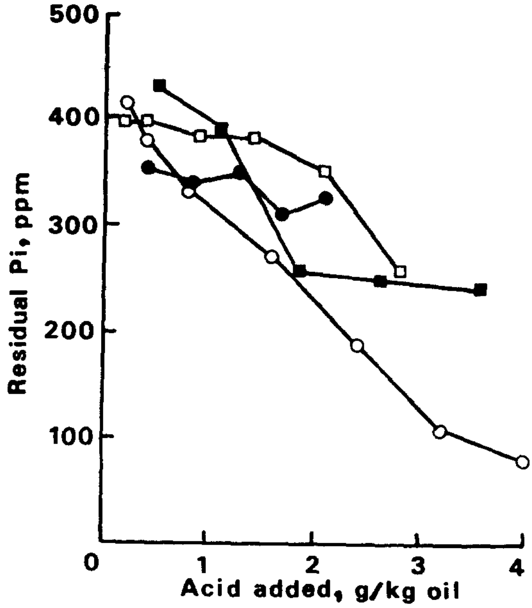


**Fig. 1. Effect of phosphoric and oxalid acid on removal of phosphatides in crude rice bran oil**
●, 85% phophoric acid; ○, 4% oxalic acid; □, 8% oxalic acid; ■, 12% oxalic acid.

oxalic acid/*kg* oil or more) and by 30*ml* of 12% oxalic acid(3.6*g* oxalic acid/*kg* oil), the water contents of crude rice bran oil become higher than 2%. The low residual phosphorus content after degumming 100*ml* of 4% oxalic acid is considered to be due to synergistic water-washing effect beside activity of degumming agent. With the above-mentioned results, efforts were made to examine water-washing effect for removal of residual phosphatides after separation of phosphatides by degumming agents.

The residual phosphorus contents after degumming by 85% phosphoric acid followed by water-washing were illustrated in Fig. 2. Degumming with 2*ml* of 85% phosphoric acid(1.7*g* phosphoric acid/*kg* oil) resulted in the lowest residual phosphorus content as 23*ppm* and the yield (wt. of degummed-water washed oil X 100/wt. of crude oil, %) of 61%. It is reported that 1*ml* of 85% phosphoric acid added to 1*kg* of crude oil is adequate for dequmming of soybean and rapeseed oil.[8] In our study, 2*ml* of 85% phosphoric acid seemed appropriate to degum crude rice bran oil since the rice bran oil contained more non-hydratable phospholipid fraction than soybean

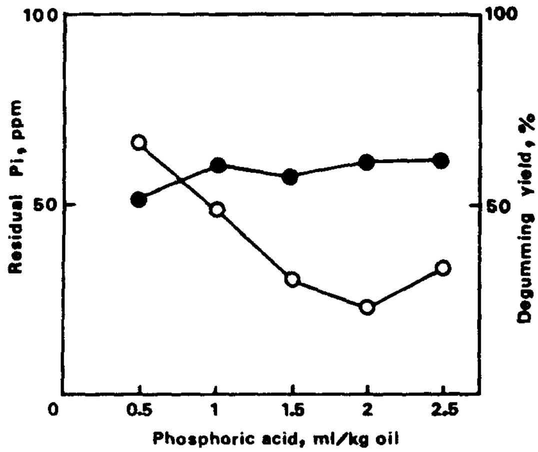


**Fig. 2. Residual phosphorus content and yield after serial treatment of phosphoric acid and water-washing** ○, residual phosphorus; ●, degumming yield.

and repessed oil.[8]

The residual phosphorus contents and yields after degumming with various concentrations of oxalic acid followed by water-washing were shown in Fig. 3. It was observed that 0.8*g*oxalic acid/*kg* oil(20*ml* of 4% oxalic acid/*kg* oil) was most effective to remove phosphatide among various conditions tested as shown in Fig. 3. Yields after degumming and water-washing with oxalic acid ranged from 59% to 77%.

The yield resulted in this study were significantly lower than theoritical yield of soybean oil(95%).[11] The crude rice bran oil had high content of mono-and diglycerides as well as free fatty acids. It was considered that mono-and diglycerides have emulsifying property and they were removed with triglycerides during hydration and separation.

Residual phosphorus content after degumming with 1*ml* of 85% phosphoric acid(0.85*g*/*kg* oil) was 48*ppm* and almost same result was also obtained by treatment with 9*ml* of 12% oxalic acid (1.08*g*/*kg* oil) and this was also reported elsewhere.[8] The efficiency of water-washing after degumming with phosphoric and oxalic acid was calculated from Fig. 1,2 and 3 as shown in Fig. 4. Water-washing after degumming by 20*ml* of 4% oxalic acid (0.89*g*/*kg* oil) was shown to be most effective. In case of water-washing after degumming with phosphoric acid, the amount of phosphoric acid added seemed not to affect the efficiency of water-washing as shown in Fig. 4. In

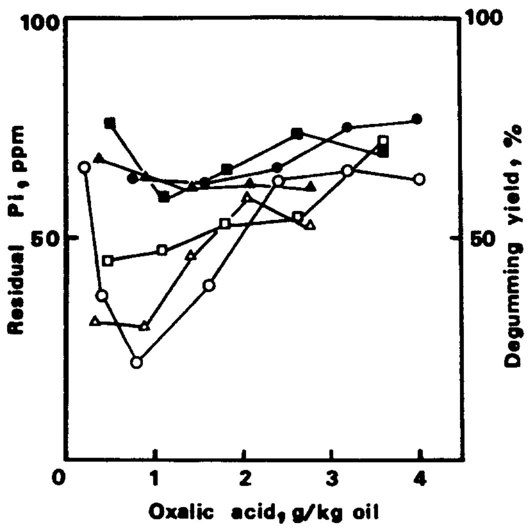


**Fig. 3. Residual phosphorus content and yield after serial trantment of oxalic acid and water-washing**
Open symbols are for residual phosphorus and closed symobols are for degumming yield. ○, 4% ; △, 8% ; □, 12% oxalic acid.

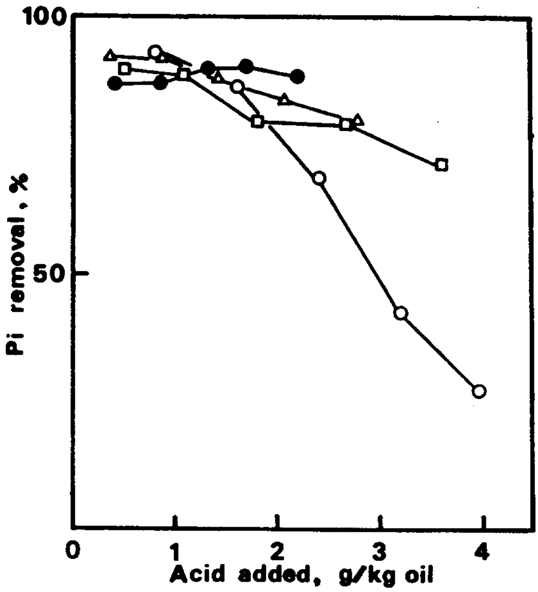


**Fig. 4. Relationship between efficiency of water-washing after degumming with phosphoric and oxalic acid and phosphorus removal**
○, 4% ; △, 8% ; □, 12% oxalic acid ; ●, 85% phosphoric acid.

this study on degumming of rice bran oil, it is found that oxalic acid also can be used as degumming agent at a level of 20*ml* of 4% solution per kilogram oil which results in the same degumming efficiency and slightly higher yield than that of phosphoric acid which is used widely in the degumming process.


## 요 약

미강유의 탈검에 알맞는 탈검제(Degumming agent)를 찾기 위하여 85% 인산과 4%, 8% 및 12% 수산의 탈검효과를 비교하였다. 85% 인산을 미강조유 1*kg*당 2*ml* 첨가할 때와 4%의 수산을 조유 1*kg*당 20*ml*를 처리할 때 미강조유내의 검물질을 96.6%까지 제거 할 수 있었다. 탐검후 수율은 인산을 이용할 때 61.0%, 수산을 이용할 때 63.6%로 나타났다.


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