# AMOUNT OF TOXIC COMPOUND IN RAPESEED MEAL

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## INTRODUCTION

In China rapeseed meals manufactured by using high glucosinolate rapeseed are used less than 8% in the mixed feeds. The rapeseed meals are found to have toxic compounds contained within.

During the processing the glucosinolates in rapeseed are hydrolyzed into ITC & OZT or decomposed into nitriles under different conditions. Daxenbichler and co-worker determined the nitriles, which are the breakdown products of pure glucosinolate in cabbage, by using infrared and gas chromatography (GC) (1,2,3,4). Youngs and Perlin (5) employed GC to separate the nitriles in Brassica campestris; the components flowing out from GC were collected and identified with infrared spectrometry. The combinated technique of GC-MS was used for the identification of glucosinolate decomposition products in rutabage, turnip, and some plants belonging to the Crucifere family (6). These determinations were carried out by using enzymatic hydrolysis to produce nitriles. Thies (7) proposed a method for determination of nitriles by using dry heating (pyrolysis) of glucosinolates. Liu (8) used the combinated technique of GC-MS and infrared to identify two kinds of nitriles contained in Chinese high glucosinolate rapeseed meal. These were 1-cyano-2-hydroxy-3-butene and 1-cyano-2-hydroxy-4-pentene. However, the amount of nitriles in meals in low glucosinolate rapeseed of Canadian origin was not mentioned in the reports of the Canadian Rapeseed Society. It was of interest, therefore, to determine the amounts of ITC, OZT and nitriles in cakes and meals from different stages of processing by the pre-pressed solvent extraction method.

## EXPERIMENT

### Method of Analysis

Into a Soxhlet extractor, 5 g rapeseed meal was accurately weighed. The meal was extracted for 8 hours using ethyl ether or dichloro-methane. The extract was transfered to a 25 ml volumetric flask, 12.5 mg methyl stearate added as an internal standard, and the volume made to 25 ml with solvent. The amount of nitriles was determined by GLC using Gas-Chrom Q 80-100 mesh.

## RESULTS AND DISCUSSION

The amounts of ITC, OZT and nitriles contained in the cake and meal in a representative sample were determined (Table 1). The amounts of ITC & OZT in the rapeseed flake increases greatly to 5340 and 6630 ppm, respectively after taking sample from a flake roller of a pre-pressed solvent extraction plant, while the amounts of ITC & OZT in the cooked rapeseed flake after a five high stack cooker was reduced to about one-tenth of original amount existed in the rapeseed flakes. This was due to the ITC & OZT being volatile. The ITC & OZT was reduced to 456 and 508 ppm, respectively in the final meal.

The amounts of ITC & OZT contained in meal of the Canadian rapeseed variety manufactured from low glucosinolate rapeseeds were determined to be 1000-2000 ppm. The sample of rapeseed flakes was taken from a plant and stored in a synthetic fiber bag for several days and this may account for nitriles not being found. The results indicate that the glucosinolates were not hydrolyzed into nitriles by myrosinase under the processing conditions. The amounts of nitriles appear and increase with the increasing temperature in the five high stack cooker, in the expeller, and during desolventization by steaming and heating. Probably the formation of nitriles in pre-pressed solvent extraction plant are due to the pyrolysis of glucosinolates by heating and will yield more by heating under moistening surroundings. Again, Table 1 indicates the total amount of the available lysine decreased with the degree of processing. The percentage of the available lysine in pre-pressed solvent extracted meal decreased to 79.2% of original rapeseed. The amounts of glucosinolate in rapeseed after flaking was quickly hydrolyzed by myrosinase contained within the rapeseed. The percentage of hydrolysis by myrosinse amounted to 47.5%, while the glucosinolates in pre-pressed solvent extracted meal were decomposed and increased to the degree of 66.9%. The toxic components existing in the solvent extracted meal originated not only from hydrolysis of glucosinolates by myrosinase in the rapeseed but also by pyrolysis of glucosinolates under moistened surrounding.

## CONCLUSION

Glucosinolates in rapeseeds are hydrolyzed by the action of myrosinase and decomposed into nitriles by the action of pyrolysis especially under steaming desolventization.

Both low and high glucosinolate containing rapeseed produce ITC & OZT in the pre-pressed solvent extracted meals within the range about 1000-2000 ppm.

One variety of high glucosinolate rapeseed processed by pre-pressed solvent extracted method produced nitriles in the amount of 122 ppm in the meal due to pyrolysis under processing conditions of cooking, screw pressing, and desolventization.

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Table 1. Analysis of pre-pressed solvent extracted meal

| Samples | Moist-ure % | Resi-dual Oil % | ITC ppm | OZT ppm | Avail. lys.% | Glucosinolate Total % | Glucosinolate Decomp. % | Glucosinolate % of Decomp. | Nitrile ppm |
|---|---|---|---|---|---|---|---|---|---|
| Rapeseed | 8.26 | 40.06 | *5340 | *6630 | 2.16 | 6.35 | 3.40 | 53.3 | --- |
| Rapeseed flake untreated | 8.40 | 40.50 | 5340 | 5730 | 2.06 | 6.32 | 3.00 | 47.5 | --- |
| Rapeseed flake heated at 95°C for 1 hr. | 5.82 | 41.12 | 5750 | 2560 | 2.34 | 6.65 | 2.22 | 33.4 | --- |
| Sample from five stack cooker | 4.35 | 40.91 | 528 | 663 | 2.02 | 6.97 | 3.55 | 50.9 | 95 |
| Sample from cooker of pre-pressed expeller | 3.28 | 40.57 | 756 | 188 | 2.01 | 6.67 | 3.38 | 49.0 | 93 |
| Pre-pressed cake | 5.84 | 11.38 | 642 | 83 | 1.87 | 5.85 | 3.27 | 55.8 | 133 |
| Meal after extractor | 8.43 | 1.05 | 1060 | 198 | 2.04 | 8.01 | 3.56 | 44.5 | 116 |
| Meal after desolvent-izing solvent | 9.11 | 1.14 | 456 | 508 | 1.71 | 6.94 | 4.64 | 66.9 | 122 |