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ISOLATION OF FERULIC ACID FROM WHEAT BRAN USING VARIOUS ADSORBENTS

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INTRODUCTION:

Wheat, together with maize and rice, accounts to about 90% of the world's cereal production. During the milling process, wheat bran, besides other valuable compounds such as wheat germ and parts of the endosperm, remains as major by-product. Wheat processing mills can produce up to 50 tons of bran per day. This waste material is suitable for further processing, as it still contains a significant proportion of various usable substances. One of these substances is ferulic acid which is widely used in various industries. Ferulic acid is contained in bran in the form of feruloylated oligosaccharides. In general, feruloylated oligosaccharides are formed of a polymerization of arabinoxylans feruloylated with ferulic acid at the O-5 position of the arabinose units.In addition, the arabinoxylans is composed of a (1–4)-β-D-xylopyranose chain substituted with L-arabinofuranose at the O-2 and/or O-3 position (Figure.1). Ferulic acid can be obtained from feruloylated oligosaccharides after hydrolysis. However, the hydrolyzate contains other substances in addition to ferulic acid, therefore it is necessary to study possibilities of separation of ferulic acid from these substances. One way to carry out this step is the application of different adsorbents and then elutuion of the bound ferulic acid from the adsorbent with a suitable solution.

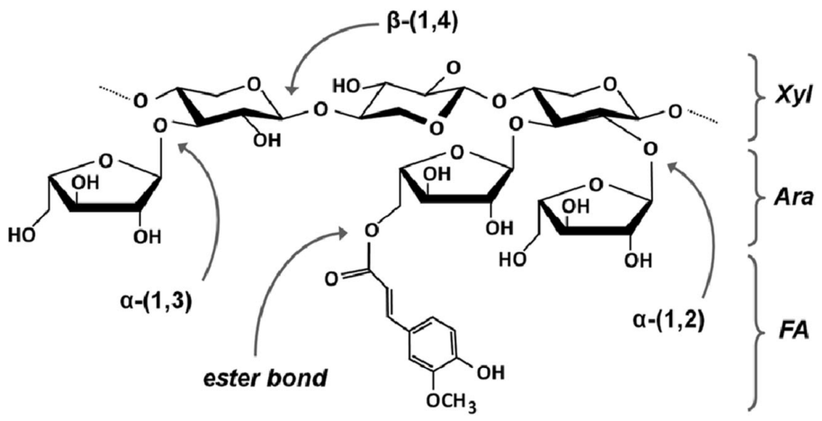
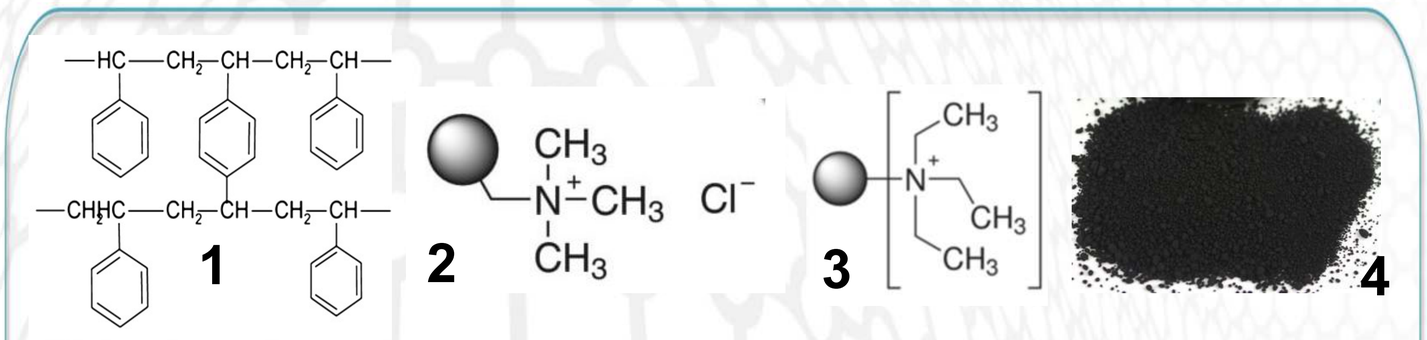


Figure 1: Ferulic acid bound to the arabinoxylan structure in wheat bran

adsorbent	Elution efficiency
AU	22,7 ± 2,3 %
A21	50,9 ± 4,6 %
IRA900Cl	0,23 ± 0,2 %
XAD 16	52,1 ± 0,7 %

Table 1: *Elution efficiency of ferulic acid from tested adsorbents*

EXPERIMENTS:



Bran hydrolysis was performed with 0.5 M NaOH solution at 50 °C for 4 hours.
After hydrolysis, the pH of the hydrolyzate was adjusted with HCl solution.
Used adsorbents:
1: Amberlyte XAD-16 (XAD-16) , 2: IRA-900Cl, 3: Amberlyst A21 (A21),
4: Activated carbon (AU)
Adsorbed ferulic acid was eluted with 0.5 % NaOH.

Analysis of ferulic acid was performed on Agilent 1260 HPLC with DAD detector (330nm), using Kinetex EVO C18 stationary phase and mixture of acetonitrile and 0.5 % acetic acid (10:90 %v/v) as mobile phase.

RESULTS:

Adsorption efficiency of ferulic acid from model solution ranged from 75 to 98 %. In the real solutions of hydrolysed bran, the adsorption efficiency decreased by up to half. Only IRA-900Cl adsorbent still showed high adsorption efficiency (Figure 2). Desorption of bound ferulic acid has proven to be problematic in some of tested adsorbents. The best desorption efficiency was achieved with Amberlite XAD-16 adsorbent (Table 1). Under the experimental conditions we obtained ferulic acid solution with concentration of 240 mg/L, which corresponds to the yield of 0.48 g of ferulic acid from 1 kg of wheat bran.

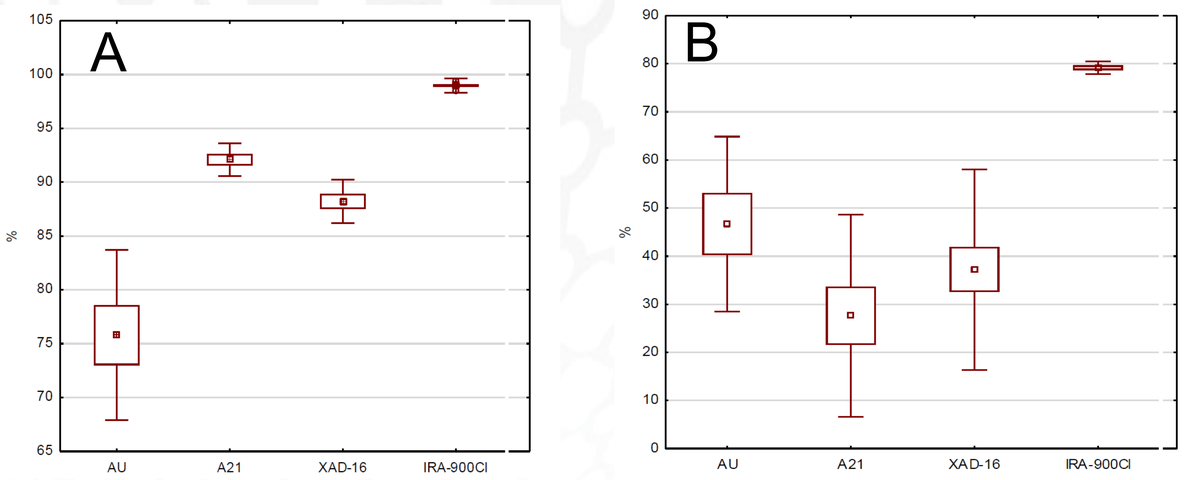


Figure 2: *Adsorption efficiency from model solutions of ferulic acid (A) and from hydrolysed bran (B)*

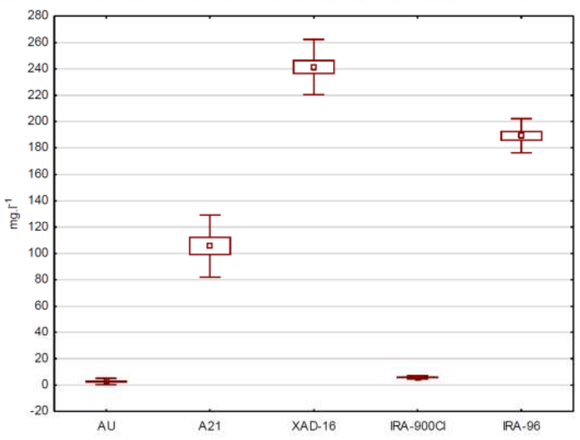


Figure 3: *Concentration of ferulic acid after elution from adsorbent*

CONCLUSION:

In this study it was demonstrated, that the wheat bran is a good source of ferulic acid. Isolation of ferulic acid from hydrolysed wheat bran is possible by different adsorbents. In our study, the best adsorbent applicable for these purposes was Amberlyt XAD-16. By using this type of adsorbent about 0.5 g of ferulic acid can be obtained after hydrolysis of 1kg of wheat bran, however, elution conditions as well as treatment of the hydrolyzate prior to sorption should be further investigated. Under optimized conditions, not only can the extraction efficiency be increased, but also ferulic acid of higher purity can be obtained.

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