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Alkaloid Concentration Control in Cat's Claw (*Uncaria tomentosa* [Willd.] DC) Extracts with Conventional Dynamic Maceration

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1 Introduction

In recent years much more interest for the natural food productions has grown up due to the pursuit of healthy eating, and the increasing demand of natural health products. Cat's claw (*Uncaria tomentosa* [Willd.] DC) is a woody vine from Amazonas and is a traditional medicinal indian herb. It is recommended for the treatment of arthritis and as general immune system booster. Anticancer and antiviral effects are also reported, which makes it well known around the world. The medical effects of the plant are due to pentacyclic alkaloids (POA), triterpenes, flavonoids and tannins, which can be found in the bark. The use and marketing of the herb and its' extracts are legal in many countries (e.g.: USA, Austria), while in other countries such as Hungary, application of cat's claw is restricted, due to its high alkaloid content. The aim of the research was to control the alkaloid concentration in the extracts with conventional extraction methods, which can be the basis for further product development and standardization.[i]

2 Experimental

During our research milled cat's claw bark was used and the following solvents were applied for extraction: water, ethanol, 50:50 water – ethanol with and without citric acid. Conventional dynamic maceration was performed, alkaloid concentration and the yield corrected with citric acid were selected as target parameters.

Citric acid (E330) is a typical component of the final products in food industry, and in nutraceutical supplements as an acidity regulator additive and preservative effects. We chose the citric acid to control the pH of the extraction solvent, because the acid pH is beneficial for extracting the basic alkaloids.

At first the effect of drug – solvent ratio was investigated, where the 1 g drug:20 ml solvent ratio has shown the best results, due to the filterability of the mixture, in addition the extract concentration was high.

Regarding extraction temperature 70 °C is the most effective, because at this temperature both alkaloid concentration and corrected yield were the highest. The extraction time in 0.5 to 2 hours range didn't show any influence on the extraction efficiency, furthermore three steps were sufficient. Effects of the solvent composition and citric acid concentration on alkaloid concentration and yield were studied by a 3^2 experimental design (Figure *Figure 1.*).

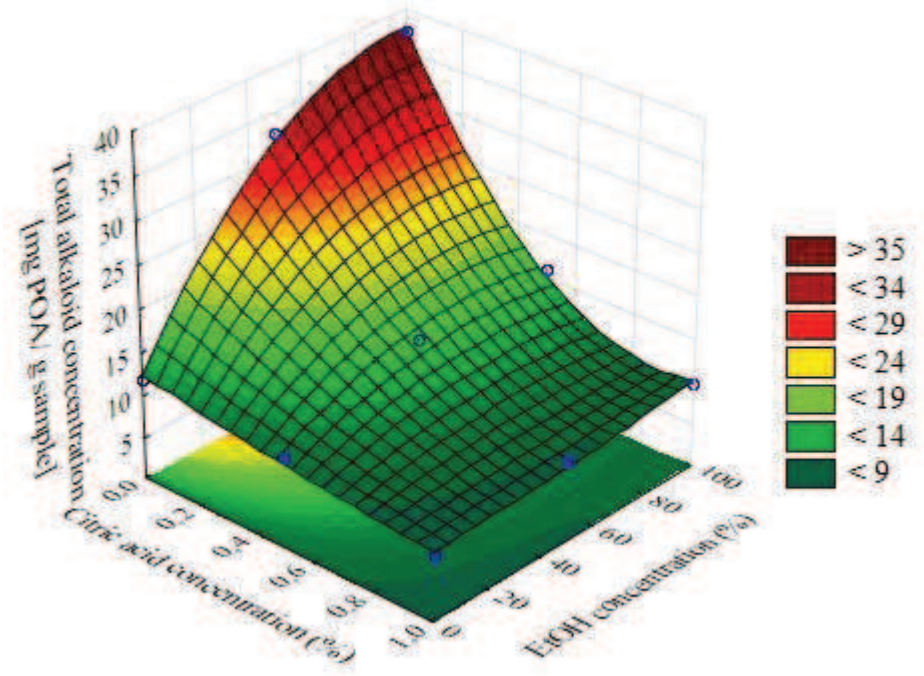

Figure 1. The total (1.+2.+3. steps) alkaloid concentration as function of citric acid mass percent and alcohol volume percent. Three step extraction (1 h mixing each, 1g:20 ml drug to solvent ratio, 70 °C)

Considering the alkaloid concentration in the extract, the highest value was obtained with 100 % ethanol and 0 m/m% citric acid. In addition, with the application of citric acid the yield increased, but the alkaloid concentration decreased. If more concentrated citric acid solution is used in extraction solvent, it results in more citric acid in the extract after evaporation of the solvent. Thus dilution effects have a major role, alkaloid recoveries (mg alkaloid in the extract/ g dry raw bark) were less emphatically affected. Based on the experimental design it can be observed that by using citric acid the alkaloid concentration can be efficiently controlled within 5 – 37.3 mg POA/ g extract. The highest alkaloid concentration can be achieved by using citric acid free absolute ethanol. The maximal corrected yield (excluding citric acid mass) was achieved at 1 – 1.2 mass percent citric acid content in 50:50 water – ethanol solvent.

In Figure 2. the antioxidant activities of the different extracts (free radical scavage activity in terms of inhibition concentration 50) are plotted.

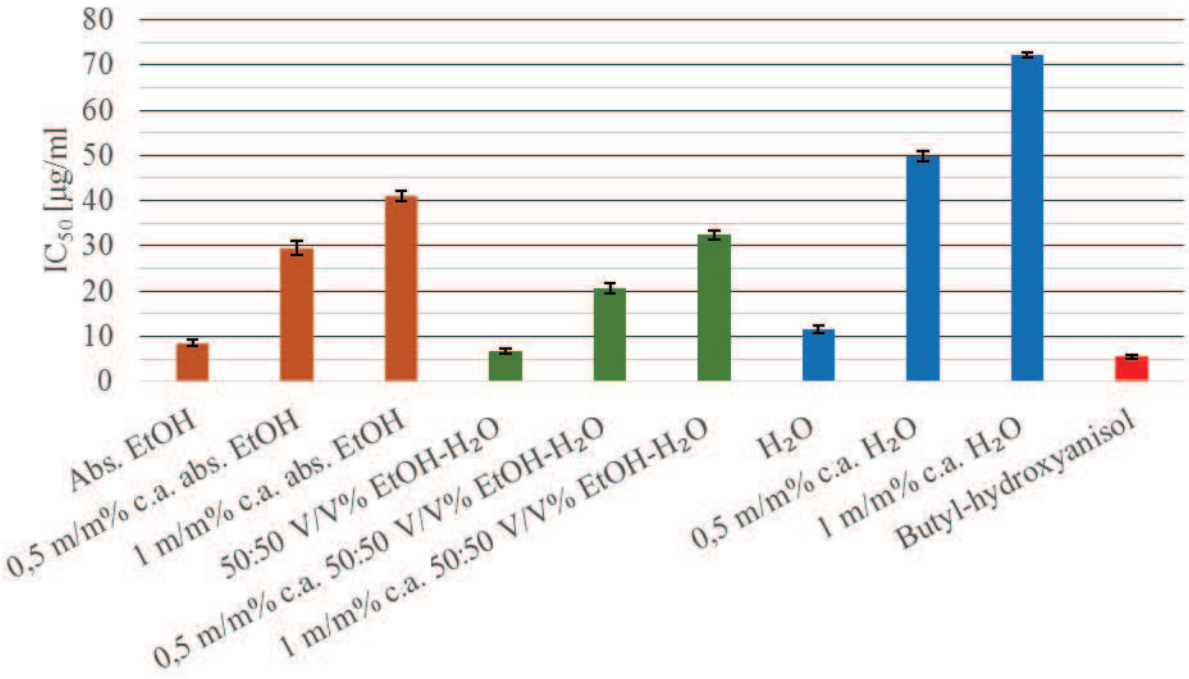

Figure 2. The 3^2 design extracts' antioxidant activity (70 °C, 1h, 1. step, c.a.= citric acid)

A synthetic antioxidant molecule, butyl hydroxyanisol (BHA), was used as reference. By increasing citric acid concentration in the extraction solvent the antioxidant activity is reduced (the IC_{50} increases). It is interesting to note, that in the food industry citric acid is considered as an antioxidant molecule, although mainly to maintain the color of the products, but our results show, that the citric acid content extracts have lower scavenger ability, than the citric acid free extracts. Furthermore we can say, that the 50:50 water-ethanol solvent- extract has almost the same antioxidant ability (IC_{50}= 6,7 ± 0,5 µg/ml)-the BHA (IC_{50}= 5,55 ± 0,4 µg/ml).

3 Summary

We can control the alkaloid concentration in the cat's claw extracts with different ethanol and citric acid containing solvents suitable for the production of nutraceutical products. The highest yield and concentration was found on 70 °C extraction temperature. The range of the alkaloid concentration, where we can control is 5 – 37.3 mg POA/ g extract.

Some of the extracts possess almost the same free radical scavenger ability (IC_{50}= 6,7 ± 0,5 µg/ml), as the synthetic reference components (BHA: IC_{50}= 5,55 ± 0,4 µg/ml).

The results of the investigations may allow an alkaloid standardized product development at relatively low cost and easy to implement with industrial scale technique.

4 Acknowledgement

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5 References

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