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OPTIMIZATION CONDITION FOR EXTRACTION OF ROSEMARY ESSENTAIL OIL BY RESPONSE SURFACE METHODOLOGY

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ABSTRACT

Response surface system (RSM) is utilized to assess the impacts of preparing parameters of a current extraction handle: the quick controlled pressure drop on the extraction yield of rosemary essential oil. The content was determined using HPLC method and steam distillation process with change in pressure. Here gas chromatography was used to identify volatile oil.. In this study the tested parameters were temperature which was initially at 20 - 80 degree C, extraction time 30 – 120 and modifier concentration to be 5 - 20 % using response surface methodology. Extraction temperature and time were the two major factors affecting extraction yield. Here by analysis, the optimized results were the temperature to be 50 degree C and concentration to be of 12.50 and extraction time to be 75 min. So an increase in extraction rate and in yield is observed.

KEYWORDS: Response Surface Methodology, HPLC, Rosemary & Extraction

INTRODUCTION

Rosemary is an essential oil and can be used as antifungal and antibacterial agent. There is a constant demand for essential oil in food, pharmaceutical, perfumery due to its quality in current years. Such a herb is used as fresh otherwise as dried or as oil or oleoresin. Nowadays there is a growing importance for the use of antioxidants because of its preservation and human health (Cuveliver, Berest, Richard 1996). As a natural antioxidant, this can be used to protect lipids in food. Studies by several scientists showed that, the essential oil of cinnamon, pimento, cove and rosemary remained most lively.

There are some disadvantages for extraction of essential oil. Steam distillation and elevated temperature results in biochemical alteration and there will be damage in volatile molecules while solvent extraction is impossible to obtain solvent free product which result in highly volatile compound. DIC process was used for drying techniques of food products and is based on thermo mechanical processing that is fast change from high steam to gas pressure to vacuum.

RSM is a statical method designed to determine and solve multivariate equations. By, optimizing various parameters, this can be used in food research. For compact number of experimental trials, RSM is useful to evaluate multiple parameters and their interactions. The global extraction efficiency of essential oil from rosemary leaves, helps to assess the effect of processing parameters and this paper deals with extraction yield of rosemary oil.

METHODOLOGY

Plant Material

Rosemary leaves are grown, collected and was dried and Initially moisture content was 9.7g/100g on dry basis.

Experimental Procedure

The analytical procedure consists of processing vessel, vacuum system and pneumatic valve. The samples were collected and treated inside the processing vessel. Vacuum system is present in which it had vacuum tank. Inside the reactor pneumatic valve is present which ensures rapid decompression.

Extraction by Pressure Drop Process

Humidified leaves ($4^{o}c$ - $5^{o}c$) are kept in DIC reactor (under vacuum). Here vacuum allows better diffusion. Steam is created in reactor and is done under thermal treatment followed by rapid decompression. So, final temperature is equal to final pressure through evaporation under adiabatic condition. By this way the extract and steam are recovered.

Isolation of Essential Oil

Rosemary leaves were collected and kept inside reactor by various treatment. Humidification by homogenization by pressure drop process and leaves are treated and analyzed. To quantify the essential oil, steam distillation is used. By this we get two phases that is organic and aqueous phase.

Experimental Design

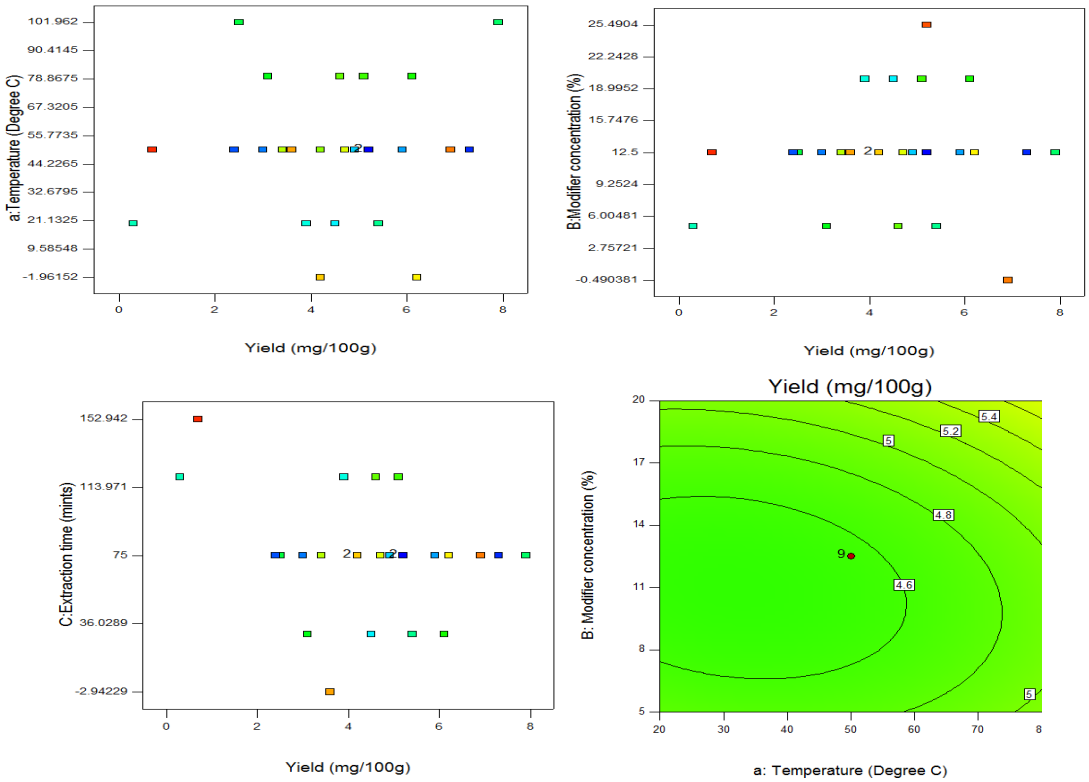
To obtain high extraction yield study was carried out by using RSM. This was employed to find the combined effect of three parameters – temperature, modifier concentration and extraction time. These three independent variables were coded as A, B, and C, respectively. A central composite rotational design with quadratic model was employed to study the combined effect of three independent variables and with 22 experiments . The results were obtained by using analysis design procedure of stastical plus for windows. These dependent variables were expressed individually as a function of the independent variables known as response function. The variance for each factor assessed was partitioned into linear and were represented using the second order polynomial function as follows

$$Y = 7.36359 - 0.060483A – 0.23620B + 0.010535C + (4.44444E – 004)AB + (5.74074E-004)AC + (7.40741E – 004)BC + (1.98722 – 004E)A^2 + (7.57721E – 003)B^2 - (4.31497E – 004)C^2$$

Table 1: Study was done for Different Runs and Corresponding Response were Obtained.

Select	Std	Group	Run	Factor 1 a:Temperature Degree C	Factor 2 B:Modifier co... %	Factor 3 C:Extraction ... mints	Response 1 Yield mg/100g
	25	1	1	50	12.5	75	5.2
	24	1	2	50	12.5	75	7.3
	23	1	3	50	12.5	75	2.4
	21	2	4	50	12.5	75	3
	22	2	5	50	12.5	75	5.9
	20	2	6	50	12.5	75	4.9
	2	3	7	20	20	30	4.5
	4	3	8	20	20	120	3.9
	3	3	9	20	5	120	0.3
	1	3	10	20	5	30	5.4
	14	4	11	101.962	12.5	75	7.9
	15	4	12	101.962	12.5	75	2.5
	5	5	13	80	5	30	3.1
	6	5	14	80	20	30	6.1
	8	5	15	80	20	120	5.1
	7	5	16	80	5	120	4.6
	11	6	17	50	12.5	75	4.2
	10	6	18	50	12.5	75	3.4
	9	6	19	50	12.5	75	4.7
	13	7	20	-1.96152	12.5	75	6.2
	12	7	21	-1.96152	12.5	75	4.2
	18	8	22	50	12.5	-2.94229	3.6
	16	8	23	50	-0.490381	75	6.9
	17	8	24	50	25.4904	75	5.2
	19	8	25	50	12.5	152.942	0.7

RESULTS AND DISCUSSIONS



EFFECT OF TEMERATURE

The effect of extraction temperature on extraction yield was studied to optimize the extraction process that is from 20 -80 degree C. Yield was decreased when extraction temperature was increased from 40 to 80 C. So, with different temperature the extraction is followed and the optimized one is 50 degree.

EXTRACTION TIME

Time is important index in evaluating the extraction efficiency and is one of the main factor. As, the shorter time results in incomplete extraction and if it takes long time to complete the process it may cause solvent wasting. To obtain high yield first static extraction is done and then with dynamic extraction. So, to evaluate the effect of extraction time we performed with different values of time from 30 – 120 min. So the optimized value of extraction time is 75min which give more yield compared to others.

MODIFIER CONCENTRATION

This is important thing in extraction process. There are two important things in modifier concentration: to increase the polarity and to improve the solubility of analytes and other factor is desorption of analytes. Yield can be increased with increasing concentration from 5 – 20 percent, but concentration increased in a vice versa manner. The optimized value is 12.5 which give a better result.

CONCLUSIONS

RSM is a useful tool in evaluating the optimum condition of essential oil of rosemary. In these study effects of parameters like temperature, time, and concentration was studied. As, we run by using software the optimized time to be 75

min and of modifier concentration to be 12.5% and extraction temperature to be 50 degree C. So it is used for the extraction of any essential oil by RSM and the responses can be found by polynomial response model equation. Most important feature of this process is that it gives short extraction time of oil with heat zones to avoid harmful thermal reactions and it does not require any use of solvent.

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