



QUALITATIVE GC-MS ANALYSIS OF HERB ESSENTIAL OILS AND THEIR POTENTIAL USE AS FISH FEED SUPPLEMENTS



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INTRODUCTION

The aquaculture sector is one of the main activities contributing to food security for humanity around the globe. However, aquatic animals are susceptible to several farming stressors involved in deteriorated growth performance, reduced productivity and eventually high mortality rates. To this day, antibiotics and chemotherapies are comprehensively applied to control biotic stressors. Aside from the apparent benefits, the continuous usage of antibiotics develops bacterial resistance, deteriorates bacterial populations and accumulates these compounds in the aquatic environment [1]. Alternatively, environmentally friendly additives can be used to avoid the direct and indirect impacts on the aquatic ecosystem and subsequently on human health. In aquaculture, medicinal herbs and extracts are extensively used and approved for their growth-promoting, anti-inflammatory, and antioxidative properties. Herbal essential oils contain many bioactive components with powerful antibacterial, antioxidant, and immunostimulant potentials, suggesting their application for aquatic animals [2]. Essential oils can be provided via diet and can benefit aquatic animals by improving their well-being and health status. In this work, essential oils of rosemary, thyme, conehead thyme and garlic were analyzed by GC-MS in order to identify their bioactive ingredients and explore their potential use as fish feed supplements.

EXPERIMENTAL

Rosemary (*Rosmarinus officinalis*), thyme (*Thymus vulgaris*), conehead thyme (*Thymus capitatus*) and eucalyptus (*Eucalyptus globulus*) essential oils were supplied by Chiron Kentavros-Greek Organic Herbs (Chiron Kentavros, Drakeia, Thessaly, Greece), while garlic (*Allium sativum*) essential oil was supplied by a local greek producer. Prior to analysis, 200 ppm solution of each essential oil was prepared in hexane. GC–MS analysis was performed by using a GC-2030 gas chromatographic system coupled to a GCMS-QP2020 NX single quadrupole mass detector (Shimadzu Corporation, Kyoto, Japan), equipped with an SP-2340 30 m × 20 μm × 0.25 μm fused silica capillary column (Supelco, Bellefonte, PA, US). The oven temperature was started at 50 °C, increased to 100 °C at 10 °C min⁻¹ rate, then to 220 °C at 15 °C min⁻¹ rate and hold at 220 °C for 7 min. Helium was used as a carrier gas at 1 mL × min⁻¹ column flow, inlet temperature 220 °C and split 20:1. The mass range was 40–400 and compounds were identified by comparison of their mass spectra with the data of NIST and Wiley mass spectral libraries. The retention times of compounds were converted to the respective Kovats Retention Indices (RI) by analyzing a standard C7–C30 alkane mixture with the abovementioned gas-chromatographic method and using the equation (1):

$$RI = 100 \times \left[n + (N - n) \frac{t_{r(compound)} - t_{r(n)}}{t_{r(N)} - t_{r(n)}} \right] \quad (1)$$

where RI: Kovats retention index
n: the number of carbon atoms in the smaller n-alkane
N: the number of carbon atoms in the larger n-alkane
tr: the retention time

RESULTS AND DISCUSSION

Results of the qualitative analysis of the main compounds of the essential oils expressed as % percentages are shown in Table 1.

Table 1. Main composition of investigated essential oils

Essential Oil	Compound	% Content	% SD	RI
Rosemary (<i>Rosmarinus officinalis</i>)	Eucalyptol	47.4	5.77	986
	α-Pinene	9.98	1.18	936
	Camphor	4.24	0.19	1175
Thyme (<i>Thymus vulgaris</i>)	Thymol	38.3	4.48	1296
	P-Cymene	31.6	0.70	1028
	Linalool	7.84	0.39	1100
Conehead Thyme (<i>Thymus capitatus</i>)	Carvacrol	21.8	0.86	1296
	p-Cymene	5.27	1.52	1028
	Linalool	2.71	0.99	1100
Eucalyptus (<i>Eucalyptus globulus</i>)	Eucalyptol	75.8	5.36	986
	p-Cymene	1.11	0.06	1028
	D-Limonene	1.01	0.08	957
Garlic (<i>Allium sativum</i>)	Propyl-propane thiosulfonate (PTSO)	39.6	3.62	1423
	Dipropyl trisulfide	1.59	0.06	1215
	Dipropyl disulfide	0.60	0.09	1088

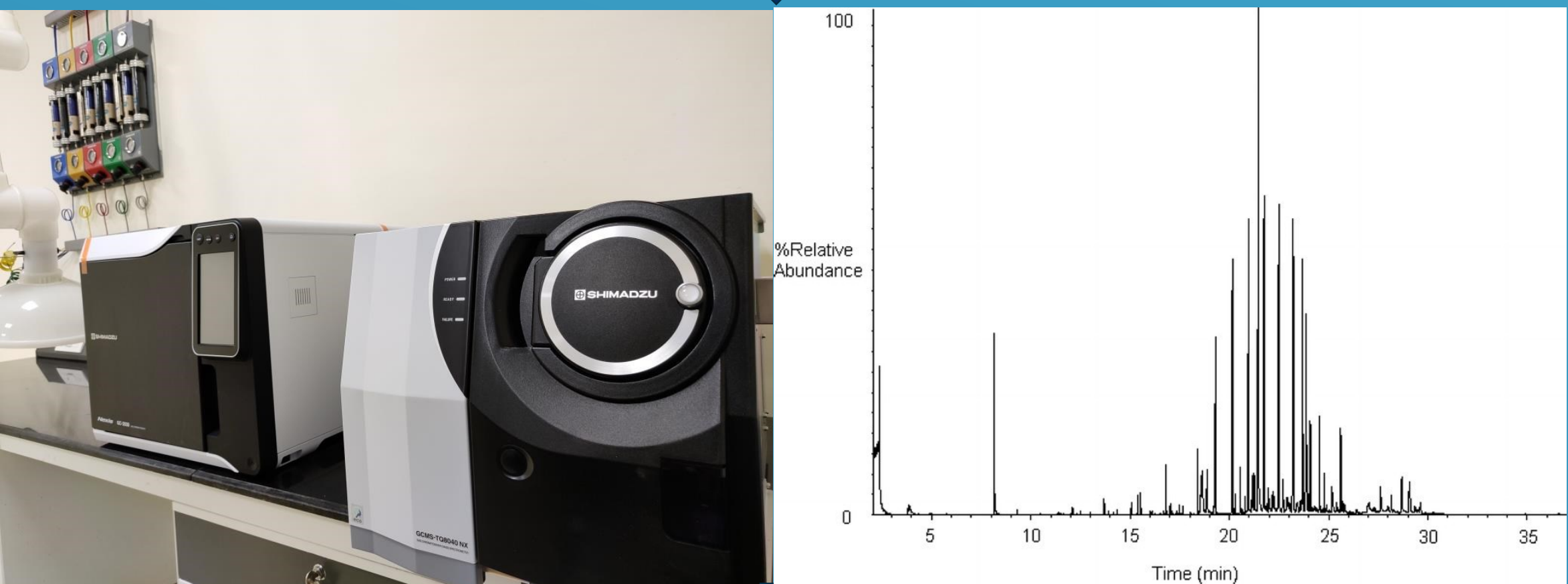


Figure 1. Graphical illustration of work flow

CONCLUSIONS

The main constituents of the essential oils consist more than half of bioactive substances with proven antioxidant, anti-inflammatory, antiseptic, antibacterial, antifungal, antiviral, antinociceptive and cicatrizing activity. Such compounds are for example eucalyptol, thymol, carvacrol and organosulfur compounds in the case of garlic essential oil. Therefore, the introduction of essential oils in fish feed, especially in encapsulated formulations, seems that can only prove beneficial for fish health, improving their overall status and reducing the need for synthetic drugs and additives in fish feed.

References

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