

Essential oil of two plant species from Peniche coast *Crithmum maritimum* L. and *Juniperus phoenicea subsp. turbinata* (Guss. parl.): Assessment of antimicrobial and antioxidant activities

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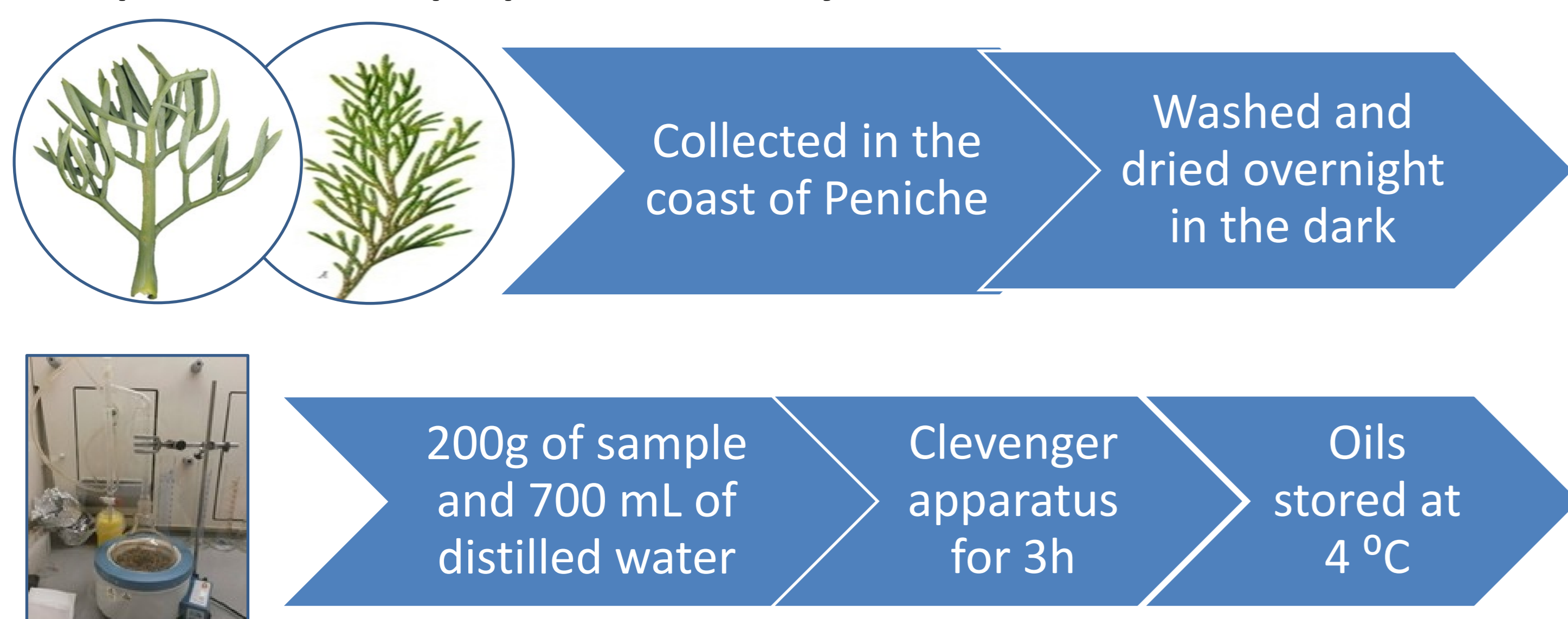
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Introduction

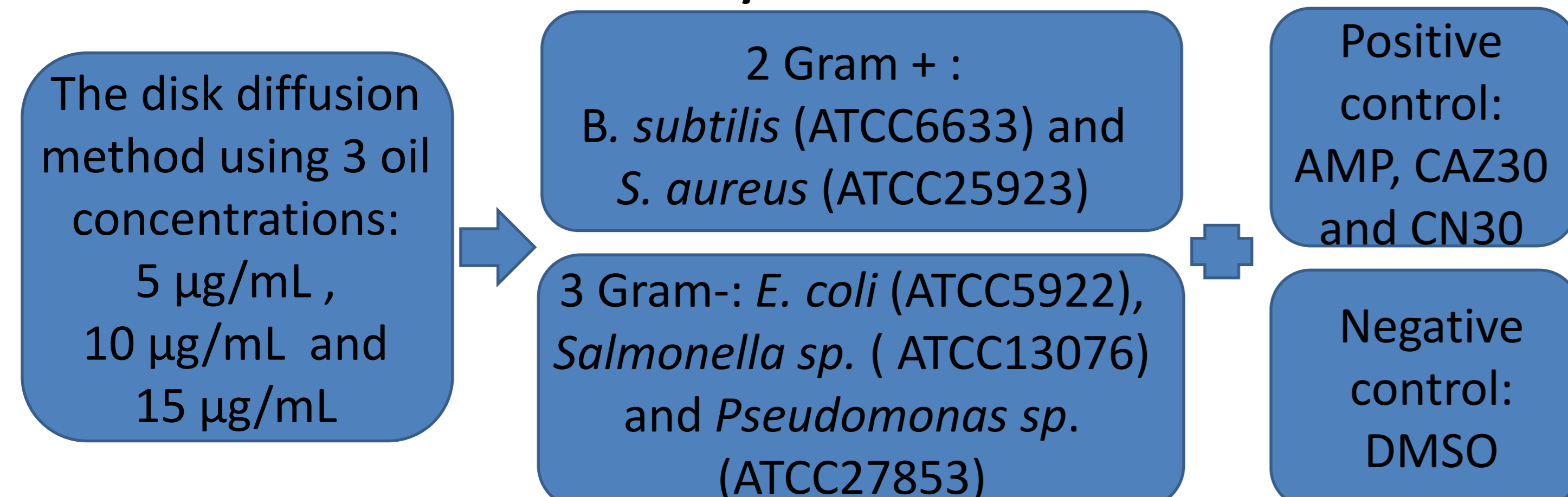
Crithmum maritimum is a facultative halophile found all over the European coast, whose leaves are rich in bioactive substances used as insecticides, flavourings and antimicrobial agents. *Juniperus phoenicea subsp. turbinata* is a coastal plant spread throughout the Mediterranean whose leaves and galbulus are used in bronco-pulmonary disease treatment. Both have essential oils, produced as secondary metabolite of aromatic plants metabolism that may present antimicrobial, antioxidant, antifungal and even anti-tumoral activity. The aim of this study was to extract essential oils from these two native plants from the coast of Peniche and test their ability as antibacterial agents and their antioxidant activity. The plants studied for this purpose were *Crithmum maritimum* and *Juniperus phoenicea subsp. turbinata*.

Methodology

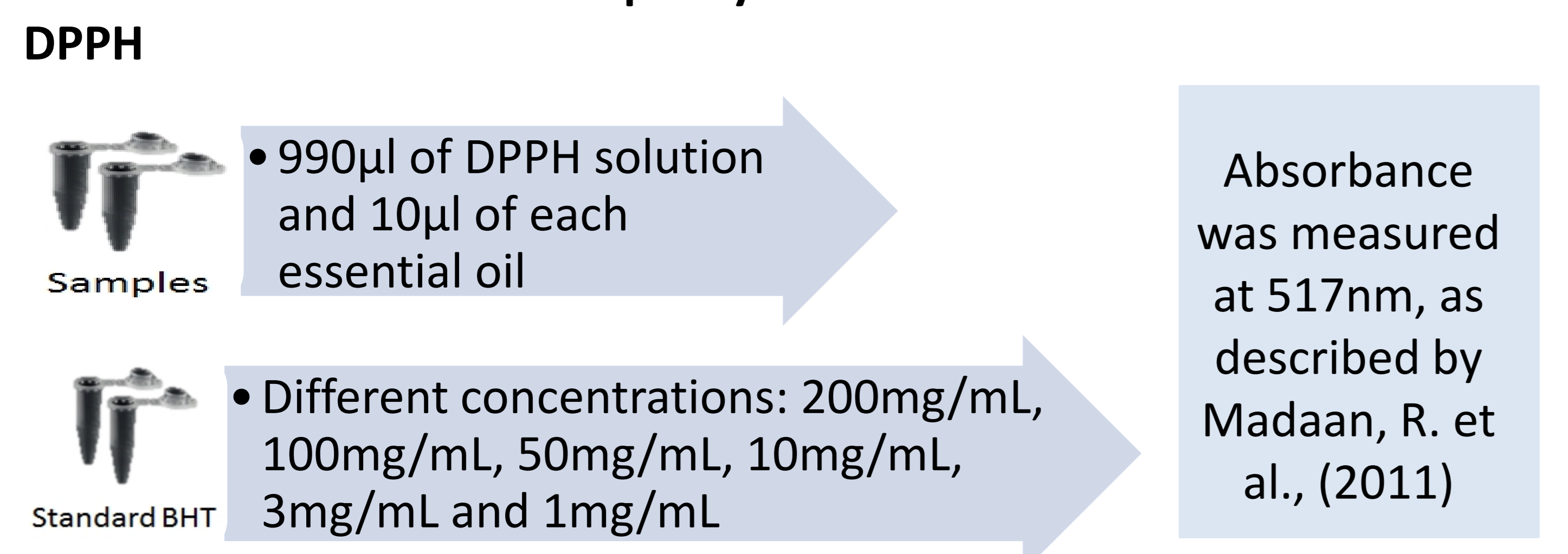
Sample collection, preparation and hydrodistillation



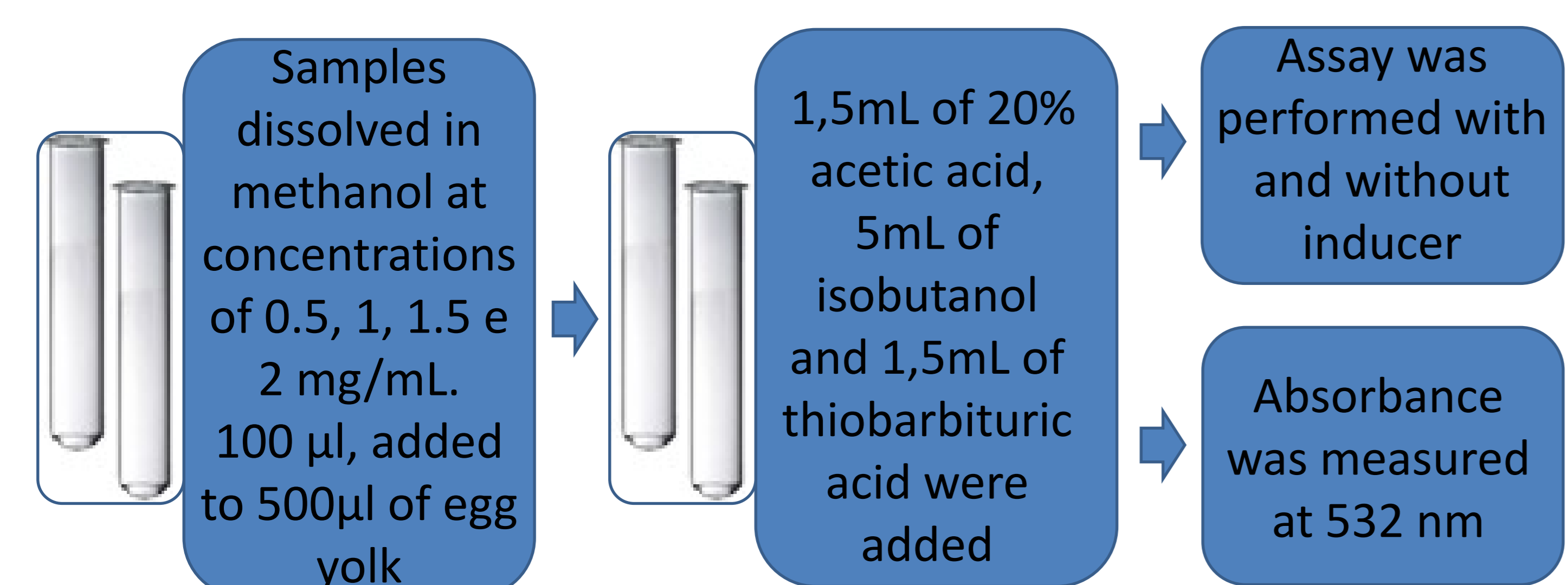
Evaluation of antibacterial activity



Evaluation of antioxidant capacity



TBARS



Conclusion

Juniperus phoenicea subsp. turbinata provides a greater amount of oil than coastal plant *Crithmum maritimum* although *Crithmum sp.* showed higher antibacterial activity against the two gram-positive bacterial strains under study and relevant antioxidant activity, in the presence and absence of an inducer. These are promising results for the pharmaceutical and food industry, for the production of new natural molecules with bioactive properties.

Results and discussion

Extraction yield

Table I. Amount and yield of oil extraction by hydrodistillation.

Oil	Amount (Mean ± SD) (ml)	Yield % (Mean ± SD) (mL/100g)
<i>Crithmum maritimum</i>	0,73 ± 0,2	0,36 ± 0,01
<i>Juniperus phoenicea subsp. turbinata</i>	35,78 ± 0,4	17,89 ± 0,2

Evaluation of antibacterial activity

Table II. Antibacterial activity of essential oils from *Crithmum maritimum* (oil 1) and *Juniperus phoenicea subsp. turbinata* (oil 2) against two Gram-positive and three Gram-negative bacteria, in that order. Inhibition zones include disc diameter (6mm). No inhibition represented by “-”.

Bacterial strain	Oil	Oil inhibition zone (Mean diameter ± SD)(mm)			Control inhibition zone (Mean diameter ± SD)(mm)			
		5 (µg/mL)	10 (µg/mL)	15 (µg/mL)	Neg.	AMP10	CAZ30	CN 30
<i>Bacillus sp.</i>	1	10 ± 0	11,75 ± 0,35	9,5 ± 0,71	-	50 ± 0	20 ± 0	26 ± 0
	2	-	-	14,5 ± 0,71	-	-	-	-
<i>S. aureus</i>	1	12,3 ± 0,42	11,5 ± 0,71	9,5 ± 0,71	-	32 ± 0	8 ± 0	22 ± 0
	2	10,25 ± 0,35	8,3 ± 0,42	10 ± 0	-	-	-	-
<i>Pseudomonas sp.</i>	1	-	-	-	-	-	0,8 ± 0	26 ± 0
	2	-	-	-	-	-	-	-
<i>E. coli</i>	1	-	-	-	-	26 ± 0	26 ± 0	26 ± 0
	2	-	-	-	-	-	-	-
<i>Salmonella sp.</i>	1	-	-	-	-	26 ± 0	26 ± 0	26 ± 0
	2	-	-	-	-	-	-	-

1) Lower oil concentrations (5 and 10µg/mL) showed a higher inhibition zone for both Gram-positive strains. This may be caused by the aqueous based culture medium which may difficult oil diffusion in the plates.

2) *Crithmum maritimum*'s oil showed a higher antibacterial activity against Gram-positive strains than *Juniperus phoeniceae subsp. turbinata*.

3) Both oils had no effect on Gram-negative strains' growth, as seen in Ennajar M, et al., (2009) and in Öztürk M., (2010) for *Juniperus phoenicea*. Gram-negative strains' cell wall composition and the hydrophilic nature of its external membrane difficults the oils' input, when Gram-positive strains present lipophilic terminations which allows the oil to enter the cell.

Evaluation of antioxidant capacity

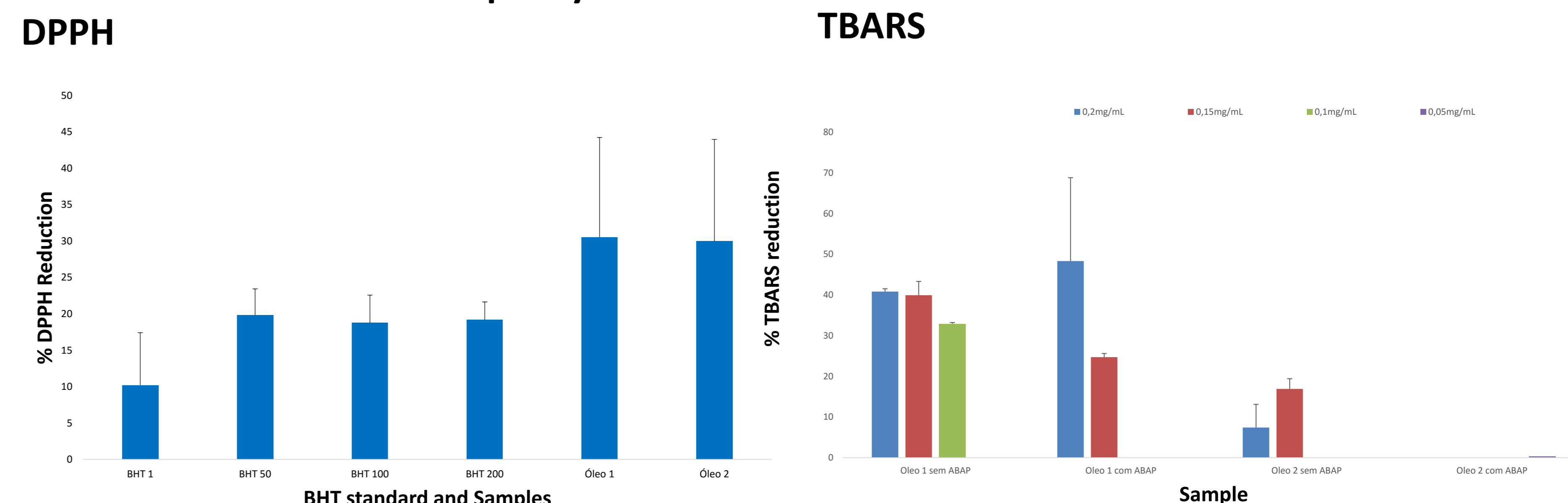


Figure 1. Graphical representation of the mean ± SD of DPPH reduction %, when comparing standard BHT with the samples.

Figure 2. Graphical representation of the mean ± SD of TBARS reduction %, when comparing to diferente concentrations of oil, with and without inducer (ABAP), without any significant statistical differences.

1) Both oils present a higher antioxidant activity when compared to standard BHT, as seen in Ennajar M. et al., (2009) and in Jallali I. et al., (2012).

2) The oil extracted from *Crithmum maritimum* showed a higher activity.

1) The oil extracted from *Crithmum maritimum* showed a higher activity, with and without inducer ABAP.

2) Antioxidant activity was lower in the presence of the inducer.