**ESSENTIAL OILS (incl. Flavour and Fragrance)**


Antibiotics and anti-inflammatory agents are the mainstay of acute external otitis (AEO) treatment. The present study investigated the effectiveness of a combination herbal drop (Lamigex) composed of essential oils from *Syzygium aromaticum*, *Lavandula angustifolia*, and *Geranium robertianum* in the alleviation of AEO symptoms and compared its effects to those of ciprofloxacin 0.3% drop. Seventy patients were randomly assigned to receive ciprofloxacin 0.3% (*n* = 35) or Lamigex (*n* = 35) drop. Each group was administered with three drops every 12 hours for a week. Patients were examined for AEO symptoms and ear discharge cultures at baseline as well as at the end of trial. Pain severity was also recorded using a visual analogue scale at baseline, the 3rd day, and the 7th day of the trial.

All assessed symptoms (tenderness, itching, erythema, edema and discharge) were equally improved in the ciprofloxacin and Lamigex groups by the end of trial (*p* > 0.05). There were remarkable reductions in the visual analogue scale score by the end of trial in both groups (*p* < 0.001). However, the rate of pain improvement was not found to be significantly different between the groups, either at the 3rd or 7th day of trial (*p* > 0.05). The numbers of positive cultures for all tested microorganisms were clearly reduced by the end of the trial in both groups but were not significantly different between the groups (*p* > 0.05). The herbal combination drop that was investigated in the present study exhibited good efficacy in reducing the burden of infection as well as AEO symptoms [Yunes Panahi (Chemical Injuries Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran), *Journal of Microbiology, Immunology and Infection*, 2014, 47(3), 211-216].

**NPARR 5(4), 2014-0354** Exploitation of apiaceae family plants as valuable renewable source of essential oils containing crops for the production of fine chemicals

Twenty two Apiaceae taxa retrieved from Greek herbal biodiversity were collected and their potency as essential oil (EO) containing crops and novel renewable sources for the production of fine chemicals (FCs) was evaluated. Their EOs and FCs production potentials were estimated on the basis of various experimental and field data, identifying the *Bupleurum fruticosum* plant as an outstanding source for its EO and the molecules of α-pinene and limonene in the form of racemic mixtures. Its production capacity per hectare is estimated to exceed the 500 L for EO, 200 L for α-pinene and 100 L for limonene. Furthermore, the following six taxa were identified for first time as potential EOs producing industrial crops: the Greek endemics *Sclerochorton junceum*, *Laserpitium pseudomeum* and *Pimpinella rigidula* and the indigenous *Seseli montanum*, *Oenanthe pimpinelloides* and *Thapsia garganica*. Finally, the Greek endemic plants *Geocarym capillifolium*, *G. parnassicum* and *Seseli parnassicum* as well as the indigenous *Selinum silaifolium* were determined as potent renewable sources for the isolation of twenty commercially important FCs such as aldehydes, aromatic compounds, saturated and unsaturated hydrocarbons, monoterpenes and sesquiterpenes. [Epameinondas Evergetis, Serkos A. Haroutounian* (Chemistry Laboratory, Agricultural University of Athens, Iera odos 75, Athens 11855, Greece), *Industrial Crops and Products*, 2014, 54, 70-77]

**NPARR 5(4), 2014-0355** Biodegradable active packaging based on cassava bagasse, polyvinyl alcohol and essential oils

The objectives of this work were to develop biodegradable trays from cassava bagasse and polyvinyl alcohol (PVA) incorporated with clove (CEO) or oregano (OEO) essential oils, to study their antimicrobial activity
and to investigate the effects of incorporating these essential oils on the mechanical properties, water absorption capacity (WAC) and sorption isotherms of the tray with the best antimicrobial activity. The trays were produced by baking 97.5% (w/w) cassava bagasse with 2.5% (w/w) PVA. CEO or OEO was added to the trays using two methods: direct incorporation (6.5 to 10.0%) and surface coating (2.5 to 7.5%). Trays with OEO prepared by surface coating showed the highest antimicrobial activity, as they were effective against molds, yeasts, and Gram-positive and Gram-negative bacteria. The addition of OEO to the cassava bagasse-PVA matrix resulted in less resistant and more flexible trays, with a decrease in the water absorption and adsorption capacities. [Flávia Debiagi, Renata K.T. Kobayashi, Gerson Nakazato, Luciano A. Panagio, Suzana Mali* (Department of Biochemistry and Biotechnology, CCE, State University of Londrina, PO BOX 6001, 86051-990 Londrina, PR, Brazil), Industrial Crops and Products, 2014, 52, 664-670].

NPARR 5(4), 2014-0356 The cytotoxic activity of Vitex agnus castus L. essential oils and their biochemical mechanisms

In this present study, essential oils from fruit and fruitless herba of Vitex agnus castus L. collected from İzmir, Turkey, were obtained by hydrodistillation using Clevenger-type apparatus for 3h. The cytotoxic and apoptotic activity of each essential oil against C6, A549 and MCF 7 cancer cell lines was evaluated in vitro by four methods. The dose-dependent cytotoxic effects of the essential oils were tested on C6, A549 and MCF 7 cancer cell lines by using MTT assay. According to MTT assay, the inhibitory effects of DNA synthesis, the apoptotic effect and the caspase-3 activation effects of each essential oil were determined by using different methods. The chemical composition of both the essential oils was analyzed by GC and GC/MS systems, simultaneously. Forty-one and thirty-nine volatile compounds were identified in both the fruit and fruitless herba essential oils representing 93.8% and 85.2% of the oils, respectively. Sabinene (22.7%, 16.9%), 1,8-cineole (18.2%, 22.4%) and (Z)-β-farnesene (16.4%, 7.5%) were found to the major compounds in both the essential oils of the fruits and fruitless herba, respectively. The fruit essential oil showed higher cytotoxic effect on all tested cancer cell lines. MCF 7 cell lines were found to be the most sensitive to both the essential oils than the others. The fruit essential oil was found to be inducing apoptosis on both of A549 and MCF 7 cell lines [H.G. Duymuş*, G. Akalın Çiftçi, Ş. Ulusoylar Yıldırım, B. Demirci, N. Kırımer (Anadolu University, Faculty of Pharmacy, Pharmacognosy Department, 26470 Eskişehir, Turkey), Industrial Crops and Products, 2014, 55, 33–42].

NPARR 5(4), 2014-0357 Antioxidant, antimicrobial and toxicological properties of Schinus molle L. essential oils

Schinus molle L. has been used in folk medicine as antibacterial, antiviral, topical antiseptic, antifungal, antioxidant, anti-inflammatory, anti-tumoural as well as antispasmodic and analgesic; however, there are few studies of pharmacological and toxicological properties of Schinus molle essential oils. The aim of this study was to evaluate the antioxidant and antimicrobial activities of Schinus molle leaf and fruit essential oils, correlated with their chemical composition and evaluate their acute toxicity. The chemical composition of Schinus molle leaf and fruit essential oils were evaluated by GC-FID and GC–MS. Antioxidant properties were determined using the 2, 2-diphenyl-1-picryl-hydrazyl (DPPH) free radical and β-carotene/linoleic acid methods. Antimicrobial properties were evaluated by the agar disc diffusion method and minimal inhibitory concentration assay. Toxicity in Artemia salina and acute toxicity with behavioural screening in mice were evaluated.

The dominant compounds found in leaf and fruit essential oils (EOs) were monoterpenic hydrocarbons, namely α-phellandrene, β-phellandrene, β-myrcene, limonene and α-pinene. EOs
showed low scavenging antioxidant activity by the DPPH free radical method and a higher activity by the β-carotene/linoleic acid method. Antimicrobial activity of EOs was observed for Gram+, Gram− pathogenic bacteria and food spoilage fungi. EOs showed totoxicity for Artemia salina and lower toxicity in Swiss mice. The result showed that EOs of leaves and fruits of Schinus molle demonstrated antioxidant and antimicrobial properties, suggesting their potential use in food or pharmaceutical industries [Maria do Rosário Martins*, Silvia Arantes, Fátima Candeias, Maria Teresa Tinoco, Júlio Cruz-Morais (Departamento de Química, Escola de Ciências e Tecnologia, Universidade de Évora, Rua Romão Ramalho 59, 7000-671 Évora, Portugal), Journal of Ethnopharmacology, 2014, 151 (1), 485-492].

NPARR 5(4), 2014-0358 All-natural composite wound dressing films of essential oils encapsulated in sodium alginate with antimicrobial properties

We present natural polymeric composite films made of essential oils (EOs) dispersed in sodium alginate (NaAlg) matrix, with remarkable anti-microbial and anti-fungal properties have been presented. Namely, elicriso italic, chamomile blue, cinnamon, lavender, tea tree, peppermint, eucalyptus, lemongrass and lemon oils were encapsulated in the films as potential active substances. Glycerol was used to induce plasticity and surfactants were added to improve the dispersion of EOs in the NaAlg matrix. The topography, chemical composition, mechanical properties, and humidity resistance of the films are presented analytically. Antimicrobial tests were conducted on films containing different percentages of EOs against Escherichia coli bacteria and Candida albicans fungi, and the films were characterized as effective or not. Such diverse types of essential oil-fortified alginate films can find many applications mainly as disposable wound dressings but also in food packaging, medical device protection and disinfection, and indoor air quality improvement materials, to name a few [Ioannis Liakos*, Loris Rizzello, David J. Scurr, Pier Paolo Pompa, Ilker S. Bayer Athanassi Athanassiou (Nanophysics, Istituto Italiano di Tecnologia (IIT), via Morego 30, 16163 Genova, Italy), International Journal of Pharmaceutics, 2014, 463 (2), 137-145]