



- (51) **International Patent Classification:** Not classified
- (21) **International Application Number:**
PCT/CZ2013/000029
- (22) **International Filing Date:**
8 March 2013 (08.03.2013)
- (25) **Filing Language:** Czech
- (26) **Publication Language:** English
- (30) **Priority Data:**
PV 2012-167 9 March 2012 (09.03.2012) CZ
- (71) **Applicant:** TOMAS BATA UNIVERSITY IN ZLIN
[CZ/CZ]; Nam. T.G.Masaryka 5555, 76001 Zlin (CZ).
- (72) **Inventors:** SEDLARIK, Vladimir; Jar. Stasi 1148, 76302
Zlin - Malenovice (CZ). KUCHARCZYK, Pavel; 491
Detmarovice, 73571 Detmarovice (CZ). SAHA, Petr;
Naves 4, 76001 Zlin - Mladcova (CZ). VALASEK, Pavel;
Lerchova 652, 68601 Uherske Hradiste (CZ).
- (74) **Agent:** GÖRIG, Jan; University Institute, Tomas Bata
University in Zlin, Nam. T.G.Masaryka 5555, 76001 Zlin
(CZ).
- (81) **Designated States** (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,
NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,
RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ,
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA,
ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Published:

- *without international search report and to be republished
upon receipt of that report (Rule 48.2(g))*

(54) **Title:** ANTI-MICROBIAL COMPONENT AND USING OF THE SAME

(57) **Abstract:** The antimicrobial component according to the invention includes at least one compound from the group of isoprenoids, terpenes or their derivatives or unsaturated ethers that occur in liquid state at standard ambient temperature and pressure conditions, immobilized on solid carrier -sorbent. The terpene based substance is preferably a compound containing at least one isoprene unit and/or at least one benzene ring in its chemical structure. The sorbent is preferably an organic substance based on polysaccharides or their derivatives, especially cellulose or starch, polyphenol based compound such as lignin, organic substance based on peptides and their derivatives, substance based on aluminosilicates (zeolites) and other substances containing silicon dioxide or an inorganic substance used as a plastic additive based on inorganic salts of calcium, particularly carbonates, sulphates, carbon black or talc.



ANTI-MICROBIAL COMPONENT AND USING OF THE SAME

Field of Invention

The invention deals with antimicrobial component with immobilized aromatic compounds and with the application of this component as an additive for plastics, paper and protective coating paintings and for selected food and cosmetic products.

State of Art

Terpenes and their derivatives are natural based substances predominantly of plant origin. They create a significant share in ethereal and essential oils. Their chemical structure consists of two or more units of isoprene or their fragments. The terpenes and some of their derivatives are characteristic by their substantial aromatic properties and their odour can be noticed at low concentrations. Therefore they are used for aroma enhancement of some food or cosmetic products. Some of the terpenes are also characteristic by their antimicrobial properties active against both Gram-positive and Gram-negative bacterial strains.

The use of natural based monoterpenes and their derivatives as antimicrobial additives with antimicrobial effects in cosmetic, pharmaceutical and food products and in fodder is already known e.g. from the patent application PCT WO no. 2005012210.

The US patent application no. 2003113385 implements the application of extracts from plants of the genera of *Leptospermum* and *Melaleuca* containing terpenes in veterinary medicine. The use of the extracts may cause lower demand of antibiotic dosage e.g. in case of mastitis treatment.

Most of the commonly used terpenes or their derivatives occur in liquid state at standard ambient temperature and pressure conditions (SATP, 25 °C, 101.325 kPa) and they are characteristic by the high volatility at elevated temperatures. Their vapour pressure is dependent on their chemical structure. This feature is acceptable in applications where significant increase of the processing temperature is not expected or where long-term activity of the terpenes is not demanded. However, there are several fields where these factors cannot be avoided. In these cases, uneconomic losses of terpene components can occur. Plastic

processing industry can be mentioned as an example where the use of terpenes as additives is substantially limited.

Nature of Invention

The above mentioned disadvantages and shortcomings are largely eliminated by the antimicrobial component according to the invention. The nature of the technical solution consists in that it includes at least one compound from the group of isoprenoids, terpenes or their derivatives or unsaturated ethers, volatile liquid at SATP, which is immobilized on a solid carrier- sorbent.

The terpene based substances or its derivatives are preferably compounds that include at least one isoprene unit and/or at least one benzene ring in its chemical structure.

The sorbent can preferably be an organic substance based on polysaccharides or their derivatives, especially cellulose or starch, polyphenol based compound such as lignin, organic substance based on peptides and their derivatives, substance based on aluminosilicates (zeolites) and other substances containing silicon dioxide or an inorganic substance used as a plastic additive based on inorganic salts of calcium, particularly carbonates, sulphates, carbon black or talc.

The antimicrobial components according to the invention can be used for preparation of a polymer system in form of polymer melt or solution, where the concentration of the antimicrobial component is from 1 to 80 wt. %.

Another area of application of the antimicrobial component according to the invention is the preparation of antimicrobial paper products, where the concentration of the antimicrobial component is from 1 to 80 wt. %.

The antimicrobial component according to the technical solution can be applied for preparation of dispersions based on water-soluble polymers and their gels and films, where concentration of the antimicrobial component is from 1 to 80 wt. %.

Possible utilization of the antimicrobial component according to the invention is in preparation of instant food products and in cosmetics.

Liquid terpenes and other aromatic compounds are according to the invention in antimicrobial component immobilized on the solid sorbents that ensure their enhanced thermal stability and reduced volatility. Such a modified system provides wider applicability of these compounds, especially utilization of their antimicrobial properties in a wide range of the above mentioned applications.

Examples of Technical Implementation

The following specific examples clarify the nature of the invention.

Example 1

Aromatic compound Linalool (3,7-dimethylocta-1,6-dien-3-ol, CAS 78-70-6) was isothermally adsorbed at 30 °C on a zeolite based on silicon dioxide and aluminium oxide (5A CAS 1344-01-0 molecular sieves). The mass ratio Linalool:zeolite was 1:2 at the beginning of the reaction. The remaining Linalool (not adsorbed) was evaporated at room temperature after 24 hours.

Example 2

Adsorption of the aromatic compound Anethole ((E)-1-Methoxy-4-(1-propenyl)benzene, CAS 4180-23-8) was carried out under the same conditions as described in Example 1, except that the evaporation of the remaining Anethole took place at 70 °C after 24 hours.

Example 3

Adsorption of the aromatic compound Estragole 1-allyl-4-methoxybenzene, CAS 140-67-0) was carried out under the same conditions as described in Example 1, except that evaporation of the remaining Estragole took place at 50 °C after 24 hours.

Example 4

The system consisting of Linalool, Anethole and Estragole immobilized on talc ($\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$, CAS 14807-96-6) was prepared under conditions analogous to the Examples 1, 2 and 3.

Example 5

The system consisting of Linalool, Anethole and Estragole immobilized on wood flour (oak, particle size below 500 μm according to a sieve analysis) was prepared under conditions analogous to the Examples 1, 2 and 3.

Example 6

The prepared systems with immobilized aromatic compounds specified in Examples 1-5 were thermoplastically incorporated into a polymer matrix (linear low density polyethylene, LDPE) in concentration range from 1 to 50 wt. % (related to the mass of the sorbent with immobilized aromatic compound) at mixing temperature of 135 °C. The resulting mixtures, composites, were subsequently processed into thin sheets with thickness from 0.2 to 1 mm. Further, mechanical (tensile testing according the standard ČSN EN ISO 570, part 1, 2 and 3), gas barrier (tested for air according the standard ČSN EN ISO 2556) and antibacterial

properties (tested according the standard ISO 22196, testing bacterial strains: *Escherichia coli* and *Staphylococcus aureus*) of the composites were tested. All composites show a mild odour relating to the incorporated aromatic compound. All composites show enhanced mechanical and barrier properties minimally about 10 % in comparison with pure LDPE. All composites show noticeable antibacterial properties.

Example 7

The prepared systems with immobilized aromatic compounds specified in Examples 1-5 were used as components for molded pulp preparation in a concentration range from 1 to 20 wt. % (related to the mass of the dry matter). The resulting products show a feature of long-lasting release of the specific odour. Resulting products show antimicrobial properties (tested against *Escherichia coli* and *Staphylococcus aureus* by the method of cultivation in liquid medium and agar diffusion technique).

Example 8

The prepared systems with immobilized aromatic compounds specified in Examples 1-5 were incorporated into a gel matrix or into swollen polymer systems and/or solutions based on synthetic (polymers with C-C backbone chain, polyacrylic acid and its derivatives, polyethers, polyesters, polyurethanes) or natural (proteins, polysaccharides and their derivatives) polymers in concentration range from 1 to 90 wt. % (related to the mass of the dry polymer). The resulting products show a feature of long-lasting release of the specific odour. The resulting products show antimicrobial properties (tested against *Escherichia coli* and *Staphylococcus aureus* by the method of cultivation in liquid medium and agar diffusion technique).

CLAIMS

1. Antimicrobial component is characterized in that it includes at least one compound from the group of isoprenoids, terpenes or their derivatives or unsaturated ethers, volatile liquid at standard ambient temperature and pressure conditions, immobilized on a solid carrier - sorbent.
2. Antimicrobial component according to claim 1, is characterized in that the terpene based substance or its derivatives is a compound containing at least one isoprene unit and/or at least one benzene ring in its chemical structure.
3. Antimicrobial component according to claim 1, is characterized in that the sorbent is the organic substance based on polysaccharides or their derivatives, especially cellulose or starch.
4. Antimicrobial component according to claim 1, is characterized in that the sorbent is a compound based on polyphenols, such as lignin.
5. Antimicrobial component according to claim 1, is characterized in that the sorbent is an organic substance based on peptides and their derivatives.
6. Antimicrobial component according to claim 1, is characterized in that the sorbent is a substance based on aluminosilicates (zeolites) and other substances containing silicon dioxide.
7. Antimicrobial component according to claim 1, is characterized in that the sorbent is an inorganic substance used as a plastic additive based on inorganic salts of calcium, particularly carbonates, sulphates, carbon black or talc.
8. The use of the antimicrobial component according to the claims 1-7 for preparation of a polymer system in form of thermoplastically prepared mixture or polymer solution where concentration of antimicrobial component in the system is from 1 up to 80 wt. %.
9. The use of the antimicrobial component according to the claims 1-7 for preparation of an antimicrobial paper products, where concentration of the antimicrobial component is from 1 to 80 wt. %.
10. The use of the antimicrobial component according to the claims 1-7 for preparation of dispersions based on water-soluble polymers and their gels and films, where concentration of the antimicrobial component is from 1 to 80 wt. %.
11. The use of the antimicrobial component according to the claims 1-7 for preparation of instant food products and cosmetics.