FUNDING PROGRAMME: ERANET-COFUND-MANUNET III / PNCDI III, European and International Cooperation,
SUBPROGRAM: 3.2-HORIZON 2020

TITLUL PROIECTULUI/ACRONYM: Manufacturing of value-added textiles for aromatherapy and skin care benefits/ AromaTex

CONTRACT NO.: 29 / 2018

ROMANIAN PARTNERS PROJECT BUDGET: 260.012 EURO **INCDTP'S BUDGET:** 120.000 EURO

PROJECT STARTING DATA: 01.02.2018 **PROJECT ENDING DATA:** 31.12.2019

WEB PAGE: -

PARTNERS:

Coordinator: The National Research-Development Institute for Textile and Leather, INCDTP, Bucharest, Romania

Partner 1: Gheorghe Asachi Technical University of Iasi, Faculty of Textile Leather and Industrial Management, Iaşi, Romania

Partner 2: Doğal Destek Ürünleri Araştırma Sanayi Ve Ticaret A.Ş, Turkey

Partner 3: Magnum SX SRL, Bucharest, Romania

Partner 4: ÜNİTEKS Tekstil Gıda Motorlu Araçlar San. ve Tic. A.Ş., Turkey

GENERAL OBJECTIVE:

The primary objective of the AromaTex project is to produce aromatherapeutic garments (sports and leisure wear) and skin/body care products (dressings and facial masks for microbial infection treatment, and cosmetic pads for skin hydration and anti-acne) using biologically active compounds. Encapsulation and transdermal delivery technologies will be expanded as a delivery path for essential oils and apiculture products.

SPECIFIC OBJECTIVES/ TECHNOLOGICAL CHALLENGES:

1. Development of polymer bioactive compound systems with tailored properties to be used for the development of aroma therapeutic and skin/body care textiles

2. Optimization of the polymer bioactive compound systems adapted to an up-scalable technology for depositing on textile fabrics, with a particular focus on therapeutically desired effects and controlled release of essential oils.

3. Prototype pilot scale-up and validation of immobilization technology

4. Production of aroma therapeutic garments and skin/body care end products.

NOVELTY ELEMENTS/ SCIENTIFIC CONCEPT:

The AromaTex project builds on the commercial interest of SME partners in producing and selling new textiles that promote wellbeing by immobilizing biologically active compounds at the substrate surface and developing efficient, environmentally friendly functionalization bioprocesses for healthcare and stress management. The target applications are textiles used in close contact with human skin, and that could benefit in terms of life quality, by being made of natural products & ecological processes. As a project result, technological knowledge of aromatherapy, biologically active compounds compatible with the textile fabrics, and a technological way of immobilization are explained by a simulated industrial process, up to pilot-scale application and product development. Application methods of the selected polymer bioactive compound systems will be optimized from a technological, quality, ecological, and therapeutic point of view.

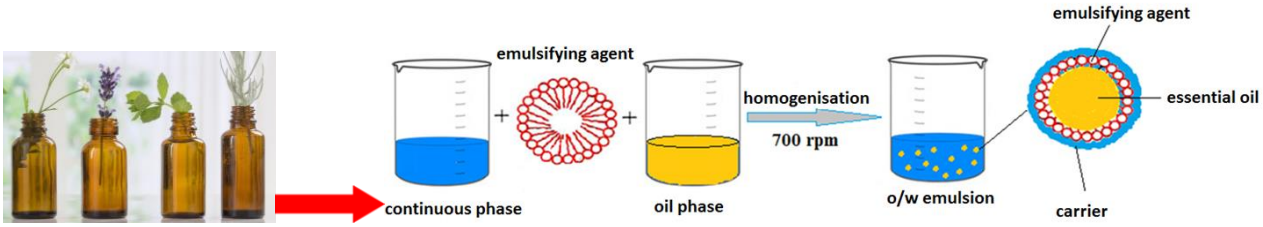
EXPECTED EXPLOITABLE RESULTS:

- ✓ A set of essential and fixed oils containing active substances & an extraction protocol
- ✓ A set of microcapsule systems with controlled release of bioactive compounds & synthesis methods
- ✓ A set of hydrogel and emulsion/dispersion systems containing essential oils & synthesis methods
- ✓ Knitted and woven textile structures compatible with the selected application field
- ✓ Optimized bioactive compound systems in the form of emulsions and microcapsules
- ✓ Optimized technologies for immobilization of polymer-bioactive compound systems on textile materials
- ✓ Prototypes of aroma therapeutic microcapsule obtained for pilot-scale application
- ✓ Prototypes of emulsions for skin/body care obtained for pilot-scale application
- ✓ Woven/ knitted textile materials prototypes containing aroma therapeutic microcapsule and/or emulsions for skin and body care

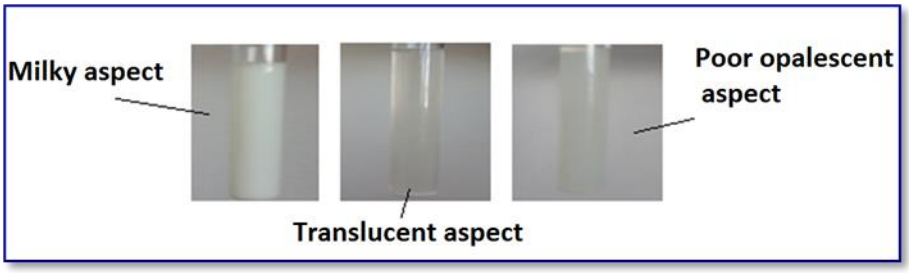
OBTAINED RESULTS :

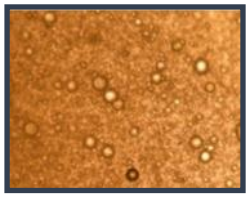
2018 :

- Biologically active systems in the forms of stable emulsions – 4 variants: **i)** beeswax – essential oil; ii) agar – chitosan – essential oil; **iii)** xanthan gum – essential oil; **iv)** xanthan gum - gelatin – essential oil;



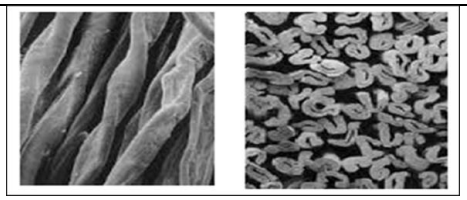
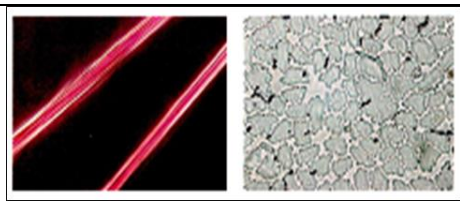
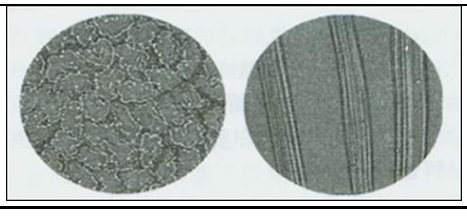
- Report on synthesis methods of stable emulsion and its characterization: aspect, pH, conductometric analysis, stability, UV-VIS analysis, quality emulsions index (acidity index, dozing of conjugated diene/triene, peroxide index, poliphenol content), senzorial index, antibacterial activity, dermal toxicity;



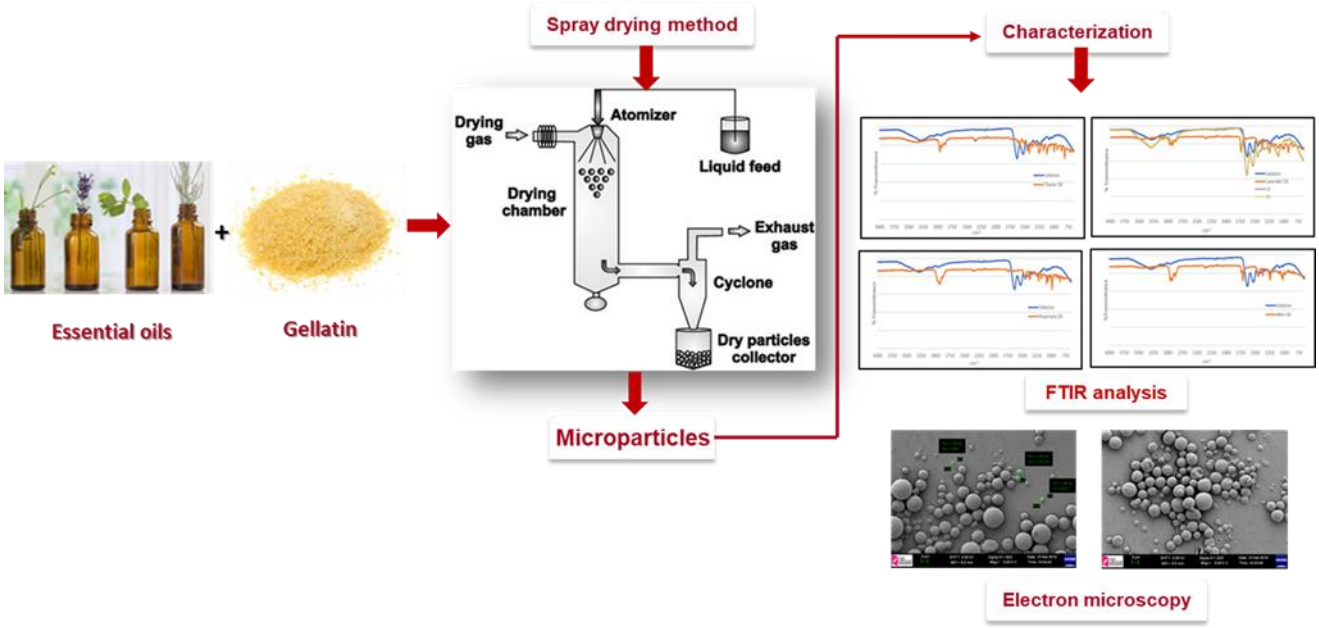


Optical analysis of emulsions ***Optical microscopy***

- Woven and knitted structures designed for aroma therapeutic and/or skin care applications;

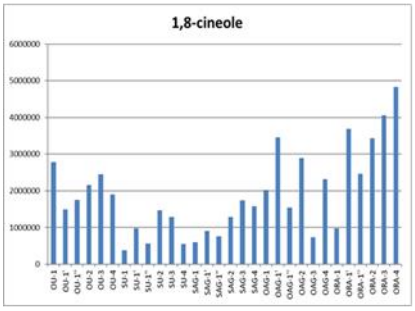
		Cotton; Longitudinal & transversal section - cotton fiber
		Cultivated tree used for the synthesis of LENPUR fiber; Longitudinal & transversal section - LENPUR fiber
		Bamboo tree used for the synthesis of Bamboo fiber; Longitudinal & transversal section – Bamboo fiber type viscose

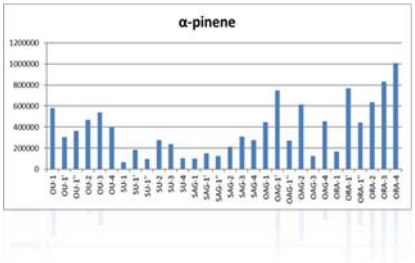
- Microcapsules containing bioactive compounds production and immobilization on textile materials of different fiber composition;



- Laboratory technology for immobilization of the polymer-bioactive compound systems (emulsions) on textile materials – 2 variants; Woven and knitted textile materials treated with stable emulsions - 36 variants;
- Laboratory technology for immobilization of microcapsules containing bioactive compounds on different textile materials – 1 variant; Woven and knitted textile materials treated with dispersions of microcapsules with essential oils – 64 variants;
- Report on complex characterization of textile materials for aromatherapy and skin care;

GS-MS:



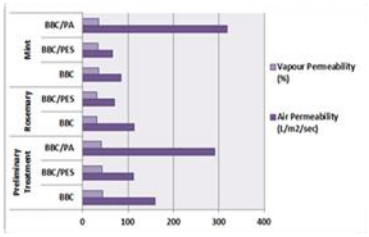


Sample	Relative Viability (%)	Conclusion
PBS*,[1]	100	-
SDS**	1.53	-
CC dry 3 min, 60°C	47.05	Irritant (I)
CL dry 3 min, 60°C	48.37	Irritant (I)
CR dry 3 min, 60°C	43.15	Irritant (I)
CM dry 3 min, 60°C	46.84	Irritant (I)
ACC dry 4 min, 50°C	49.42	Irritant (I)
ACL dry 4 min, 50°C	53.48	Non-irritant (NI)
ACR dry 4 min, 50°C	63.07	Non-irritant (NI)
XC dry 4 min, 50°C	47.05	Irritant (I)
XGC dry 4 min, 50°C	45.15	Irritant (I)

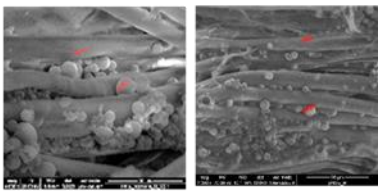
Dermal toxicity of textiles impregnated with emulsions containing essential oils

(cell viability)

Air/water vapor permeability



SEM

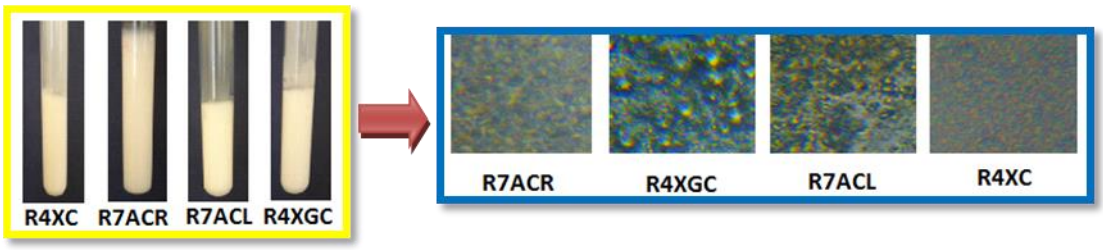


2019 :

- knitted structures variants made of Bamboo/Lenpur/polyamide fibers, treated microcapsules with melamine shell containing rosemary/mint essential oil;
- various application recipes of ethylcellulose shell microcapsules containing thyme/rosemary/lavender/ mint essential oil;
- emulsions-based biological systems containing essential oils, tested and applied on textile materials, including experimentation report of immobilization technologies;
- testing report containing general and specific characteristics of woven/knitted textile materials with aromatherapeutic and/or skin care effects obtained as prototypes;
- women's socks and men`s socks with aromatherapeutic properties, functionalized with lavender, rosemary,

mint, and thyme microcapsules;

- pillow case with aromatherapeutic properties functionalized with lavender and rosemary microcapsules;
- patches with antimicrobial, softening, and moisturizing properties containing biological polymeric systems: **i)** agar-chitosan-rosemary essential oil; **ii)** agar-chitosan-lavender essential oil; **iii)** xanthan gum-thyme essential oil; **iv)** xanthan gum-gelatin-lavender essential oil system;
- technical-economic documentation for the new products: **i)** patches with antimicrobial, softening, and moisturizing properties; **ii)** socks for women or men with aromatherapeutic properties.



Biologically active systems variants selected for application on textile materials.

Aromatherapeutic patches prototypes

Application of patches containing biologically active systems

Men`s socks prototypes (Bamboo fibres)

Men`s socks prototypes (Lenpur fibres)

Women's socks prototypes (Bamboo fibres)

Women's socks prototypes (Lenpur fibres)

Aromatherapeutic socks prototypes functionalized by immobilization of microcapsules containing thyme/ rosemary/ mint essential oil

70% cotton/ 30% linen woven fabrics treated with microcapsules with lavender essential oil content

70% cotton / 30% hemp woven fabric treated with microcapsules with rosemary essential oil content

60% cotton / 40% linen woven fabric treated with microcapsules with thyme essential oil content

Decorative pillows prototypes with aromatherapeutic effect functionalized by immobilization of microcapsules containing lavender/ rosemary/ thyme essential oils

DISSEMINATION:

- **WoS published papers:**

1. DANILA Angela, ZAHARIA Carmen, SUTEU Daniela, MURESAN Emil Ioan, LISA Gabriela, KARAVANA Sinem Yaprak, TOPRAK Ali, **POPESCU Alina, CHIRILA Laura**, *Essential mint oil-based emulsions: preparation and characterization*, Industria Textila, Vol. 70, no. 1, p. 83-87, ISSN: 1222–5347, 2019, https://doi.org/10.35530/IT.070.01.1581
2. Miruna S. STAN, **Laura CHIRILA, Alina POPESCU, Denisa M. RADULESCU, Diana E. RADULESCU,** Anca DINISCHIOTU, *Essential oil microcapsules immobilized on textiles and certain induced effects*, Materials, Vol 12, no. 12, 2019, **(IF= 2.97)**, https://doi.org/10.3390/ma12122029
3. DANILA Angela, MURESAN Emil Ioan, **POPESCU Alina,** ROTARU Vlad, ISTRATE Cristina, The potential of aroma textiles in North-East Romania, Industria Textila, Vol. 70, no. 5, p. 487-492, 2019, ISSN: 1222–5347 (**IF= 0.504**) https://doi.org/10.35530/IT.070.05.1621

- **BDI published papers:**

1. **PRICOP Floarea, POPESCU Alina, RASCOV Marian, CHIRILA Laura, Scarlat Razvan,** BUZDUGAN Maria, CEREMPEI Angela, MURESAN Emil, *Study on the aromatherapeutic effects of textiles functionalized by herbal extracts*, article published on Proceedings Volume of the 7th International Conference on Advanced Materials and Systems, 18-20 October, Bucharest, Romania, pp. 147-153, ISSN: 2068-0783;
2. MURESAN Augustin, ZAHARIA Carmen, DANILA Angela, SUTEU Daniela, MURESAN Emil Ioan, **POPESCU Alina, CHIRILA Laura,** CEZAR Radu Doru, *Preliminary research on preparation of emulsions of mint oil*, published in Proceedings Volume of The XXIInd International Conference of Inventics "Inventica 2018", Iasi, 28th June - 29th June 2018, pp. 27-35, ISSN: 1844-7880, Romania.
3. Angela DANILA, Emil Ioan MURESAN, Carmen ZAHARIA, **Alina POPESCU,** Vasile Ciprian MACAREL, *Beeswax-based emulsions for topical application*, Conference Proceedings, Vol. 19, No. 6.1, Micro and Nano Technologies Advances in Biotechnology, p. 43-50, The 19th International Multidisciplinary Scientific GeoConference SGEM 2019, 28 June - 7 July, 2019, Albena, Bulgaria
4. **Diana-Elena RADULESCU, Alina POPESCU, Angela DANILA, Laura CHIRILA, Emil** Ioan MURESAN, *Bioactivity and dermal toxicity of skin care textiles*, Conference Proceedings, Vol. 19, No. 6.1, Micro and Nano Technologies Advances in Biotechnology, p. 51-59, The 19th International Multidisciplinary Scientific GeoConference SGEM 2019, 28 June - 7 July, 2019, Albena, Bulgaria

- **Scientific communications**

1. MURESAN Augustin, ZAHARIA Carmen, DANILA Angela, SUTEU Daniela, MURESAN Emil Ioan, **POPESCU Alina, CHIRILA Laura,** CEZAR Radu Doru, *Preliminary research on preparation of emulsions of mint oil*, poster presentation at The XXII International Conference of Inventics "Inventica 2018", Iasi, 28th June - 29th June 2018, Romania;
2. DANILA Alina**, CHIRILA Laura,** COSTAN Lenuta Irina, *Kinetic modeling on rosemary essential oil release from beeswax matrix*, poster prezentation at The 7th International Technical Textiles Congress-ITTC2018, 10-12 October, 2018, Izmir, Turkey;

3. **PRICOP Floarea, POPESCU Alina, RASCOV Marian, CHIRILA Laura, Scarlat Razvan,** BUZDUGAN Maria, CEREMPEI Angela, MURESAN Emil, *Study on the aromatherapeutic effects of textiles functionalized by herbal extracts*, poster presentation at 7th International Conference on Advanced Materials and Systems, 18-20 October, Bucharest, Romania;
4. **PRICOP Floarea, POPESCU Alina, CHIRILA Laura, RASCOV Marian,** BUZDUGAN Maria, *Nature vibration in textile materials treated with plant extracts*, oral presentation at the seminar "Textile and Leather Industry through Tradition to Sustainability by Research-Development-Innovation", organized within MODEXPO FAIR, 27 September 2018, Bucharest, Romania;
5. MURESAN Augustin, DANILA Angela, MURESAN Emil Ioan, **POPESCU Alina, CHIRILA Laura,** RADU Cezar Doru, *Emulsion stability of lavender essential oil in beeswax matrix*, poster presentation at 17th Romanian Textiles and Leather Conference - CORTEP 2018, 7-9 November 2018, Iasi, Romania;
6. Sinem Yaprak KARAVANA, Gökhan ERKAN, Gizem Ceylan TÜRKOĞLU, Ayse Merih SARIISIK, Burçin ESER, Ali TOPRAK, **Alina POPESCU,** *Development of ready-made clothing products with rosemary oil to use in aromatherapy*, oral presentation at International Conference: "Advanced Textiles for a Better World -TEXTEH XI", Bucharest, 24-25 October, 2019.

Project meeting organized with Romanian partners,
June 2019, headquarters of INCDTP, Bucharest

Project meetings organized with Turkish partners,
October 2018, Cesme/ July 2019, Izmir, Turkey

Project meetings organized with Romanian and Turkish INDUSTRIAL PARTNERS:

Uniteks-Turkey and Magnum SX-Romania

CONTACT PERSON:

PhD Alina Popescu, R4 (CS I), alina.popescu@incdtp.ro

Textile Chemistry and Environmental Protection Research Department