

Maria Kanellaki

Professor of Food Chemistry & Biotechnology

SHORT PRESENTATION / PROFILE



Prof. Maria Kanellaki obtained her diploma in Chemistry in 1977 and her Ph.D. in 1983 from the Department of Chemistry, University of Patras (UP). She is member of the Food Biotechnology Group of the Department of Chemistry, UP, International Forum on Industrial Bioprocesses (IFIBiop Forum, former ICBF) and American Dairy Science Association(ADSA). She has coordinated 6 research/educational funded projects, and participated in 15. She has acted as reviewer in many peer review scientific journals and she is co-author of more than 80 research publications in international journals including 4 patents as also 6 chapters in books. She has participated in many national and international conferences and has open international collaborations with at least 5 Universities

from different countries.

RESEARCH INTERESTS / OBJECTIVES

- **Fermentation technology in food production** (Extremely low & high temperature fermentation; Improvement of food quality & nutritional value through biotechnological processing; Fermentation biocatalysts)
- **Immobilized cell biocatalysts in food production**
- **Winemaking and brewing**
- **Potable and fuel grade alcohol production**
- **Biotechnological exploitation of agro-industrial wastes for added-value products**
- **Dairy products - Probiotics**

ACADEMIC STUDIES / POSITIONS

- 1972-77:** Diploma in Chemistry, Dept. of Chemistry, UP
- 1977-83:** Research Associate, Laboratory of Inorganic & Analytical Chemistry, Dept. of Chemistry, UP
- 1983:** Ph.D. in Chemistry, Dept. of Chemistry, UP
- 1983-90:** Lecturer of Food Chemistry & Technology, Dept. of Chemistry, UP
- 1990-99:** Assistant Professor of Food Chemistry & Technology, Dept. of Chemistry, UP
- 1999-2006:** Associate Professor of Food Chemistry & Biotechnology, Dept. of Chemistry, UP
- 2006-pres.:** Professor of Food Chemistry & Biotechnology, Dept. of Chemistry, UP

RESEARCH EXPERIENCE / GRANTS (Participation and/or Coordination)

1. *Method of alcohol production using biocatalyst - DISCINOVIATION, STRIDE HELLAS, EU, 1991-1994.*
2. *Viticulture-Restructure of cultures-Enology, KEK Perfecture of Western Greece, 1999-2000.*
3. *Exploitation of whey for the production of food products employing biotechnological methods - EPET II (GSRT, EU) 1999-2001.*
4. *Quality control in the food and packaging materials industry - EPEAEK (Greek State, EU) 1997-1999.*
5. *MSc Food Biotechnology - EPEAK II (Greek State) 2002-2003.*

6. Solid wastes & by-products of agricultural industries as substrates for cell immobilization for use as starter cultures in baking processes - EPEAK II, HERAKLITOS I (Greek State, EU) **2003-2005**.
7. Production of wine and beer using freeze-dried immobilised cells in various bioreactor configurations. Potential production of commercial dry biocatalysts - Joint Research and Technology Programmes: Greece-Serbia (GSRT, EU) **2003-2005**.
8. Utilization of brewer's spent grains for production of fungal biomass and products of high added value - EPEAK II, PYTHAGORAS I (Greek State, EU) **2004-2007**.
9. The dairy liquid waste as raw material for the production of probiotic kefir cultures for use in cheese ripening - EPEAK II, PYTHAGORAS I (Greek State, EU) **2004-2007**.
10. Biotechnological exploitation of mixed dairy and sugar industry liquid wastes (whey and molasses) for the production of mixed freeze-dried cultures for bread making - EPEAK II, PYTHAGORAS II (Greek State, EU) **2004-2007**.
11. Utilisation of agro-industrial wastes as carriers for immobilisation of wine yeasts for alcoholic fermentation processes -PENED 2003 (GSRT, EU) **2005-2009**.
12. Use of Pafos mastic as carriers for yeasts immobilisation for wine making - (IPE Cyprus) **2008-2010**.
13. Novel immobilized biocatalyst for increase productivity, improvement of wine quality for industrialization in wine making - PENED 2003 (GSRT, EU) **2006-2009**.
14. Five small funded projects from the Greek Organisation EOMEX.
15. Meat products with new technologies, Hrakleitos II, (Greece State, EU) 2010-13.

RESEARCH GROUP

Staff: 4; Post-doc researchers: 3; Graduate Students: 17; Ph. D. students: 10; MSc students: 20

RESEARCH PROJECT SUPERVISION- TRAINEES

MSc Level (Msc Food Biotechnology) (supervision)

| Year | Name | Title |
|---------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1997-98 | DEMSIA G. | Fermentation for beer production using immobilized cells on delignified cellulosic material: analysis of aroma compounds |
| 1998-99 | FLARI V. | Glycerol formation by room and low temperature wine making using immobilized cells |
| | SAKELARAKI E. | Glycerol formation during wine making using immobilized cells |
| 1999-00 | SCHOINA V. | Glycerol formation in wine making by immobilized cells using gluten pellets as support |
| 2000-01 | REPA P. | Wine making by immobilized cells on grape skins |
| 2001-02 | GEORGOUSI K. | Monitoring of lactic acid concentration during ripening of Greek myzitra cheese using kefir as starter culture |
| | MALLIOS P. | Wine production using yeast immobilized on pear pieces |
| | KOGIALOS I. | Effect of various carbohydrate substrates on the production of kefir grains |
| 2002-03 | KATECHAKI E. | Production of yogurt using probiotic L. casei culture |
| | KOPSAHELIS N. | Optimization of immobilization on delignified and non- delignified brewery spent grains and the use of biocatalysts in low-temperature alcoholic fermentation |
| 2003-04 | KANDYLIS P. | Effect of freeze-dried kefir starter culture in feta-type cheese ripening |
| | RAPTI A. | Freeze dried kefir production using liquid whey as raw material |
| | PAPAKIS N. | Alcohol production from various carbohydrate substrates using yeast immobilized on brewery spent grains |
| | AGGELI K. | Ambient and low temperature wine making with yeast immobilized on spent grains. Study of volatiles by- products formation using GC-MS |
| 2004-05 | KOLIOU E. | Immobilization of kefir cells on casein for the maturation of semi- hard cheeses |

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|-----------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 2005-06 | ALMPANTAKI N. | Freeze dried immobilized cells of <i>L. casei</i> on natural supports for cheese production |
| | ZOGARI S. | Chemical in vitro evaluation of animal feeds produced by treatment of by-products of food industry with <i>A. awamori</i> and <i>A. oryzae</i> |
| | GOULA A. | Gelatinized starch as support for cell immobilization and activity of biocatalyst |
| | PAPAHRONOPOULOS A. | Ethanol production by immobilized cells in brewer's spent grains in continuous system |
| 2006-07 | TZIAKOU Z. | Evaluation of dried starter cultures for the production of whey cheese |
| 2007-08 | VARVARESOU D. | Wine making at extremely low at high temperatures in a multi-stage fixed bed tower bioreactor |
| 2008-09 | MANTAGARI A. | Single cell protein from exploitation of food industry's wastes |
| 2009-010 | RIGA F. | Volatile profile of limoncello alcoholic distillate |

Ph.D. level (supervision)

1. BEKATOROU A. Use of freeze-dried free and immobilized cells in brewing. Ph.D., Dept. of Chemistry, University of Patras, **2001**.
2. KOURKOUTAS Y. Winemaking with immobilized on fruit pieces. Ph.D., Dept. of Chemistry, University of Patras, **2002**.
3. MALLOUCHOS A. Study of volatile by-products during fermentations with immobilized cells. Ph.D., Dept. of Chemistry, University of Patras, **2003**.
4. PAPAVALSILEIOU G. Freeze-drying kefir culture in whey fermentation Ph.D., Dept. of Chemistry, University of Patras, **2007**.
5. DIMITRELLOU D. Use of free and immobilized biocatalysts in wet and dried form as probiotic cultures in traditional Greek cheese making. Ph.D., Dept. of Chemistry, University of Patras, **2009**.
6. KOPSAHELIS N. Effect of a system consisting of immobilization carriers made from agro-industrial wastes in a multi stage fixed bed tower bioreactor on wine and alcohol production. Ph.D., Dept. of Chemistry, University of Patras, **2009**.
7. BOSNEA L. Production of probiotic dairy products using wet and freeze-dried immobilized cells. Ph.D., Dept. of Chemistry, University of Patras, **2009**.

Ph.D. under supervision

8. KALLIS M. Use of new biotechnological methods in wine making
9. SIDERIS C. Use of new biotechnological methods in brewing
10. SCHOINA V. Use of new biotechnological methods in food production
11. SIDIRA M. Meat products production with new technologies

SELECTED PUBLICATIONS

1. Kana, K., Kanellaki, M., Papadimitriou, A., Psarianos, C. and Koutinas, A.A. 1989. Immobilization of *Saccharomyces cerevisiae* on γ -Alumina Pellets and its Ethanol Production in Glucose and Raisin Extract Fermentation. *J. Ferment. Bioeng.*, 68(3), 213-215.
2. Kana, K., Kanellaki, M., Psarianos, C. and Koutinas, A.A. 1989. Ethanol Production by *Saccharomyces cerevisiae* immobilised on mineral Kissiris. *J. Ferment. Bioeng.* (μέχρι το 1988 *J. Ferment. Technol.*), 68(2), 144-147.
3. Kana, K., Kanellaki, M., Papadimitriou, A. and Koutinas, A.A. 1991. Cause of and Methods to Reduce Methanol Content of Tsicoudia, Tsipouro and Ouzo. *Int. J. Food Sci. Technol.*, 26, 241-247.
4. Argiriou, T., Kaliafas, A., Psarianos, C., Kana, K., Kanellaki, M. and Koutinas A.A. 1992. New Alcohol Resistant Strains of *Saccharomyces cerevisiae* Species for Potable Alcohol Production Using Mollasse. *Appl. Biochem. Biotechnol.*, 36,153-161.

5. Argiriou, T., Kaliafas, A., Psarianos, K., Kanellaki, M., Voliotis, S and Koutinas, A.A. 1996. Psychrotolerant *Saccharomyces cerevisiae* Strains after an Adaptation Treatment for Low Temperature Wine Making. *Process Biochem.*, 31(7), 639-643.
6. Bardi, E., Koutinas, A.A., Psarianos, K. and Kanellaki, M. 1996. Volatile By-products formed in Low Temperature Wine Making by Immobilized Yeast Cells. *Process Biochem.* 32(7), 579-584.
7. Bardi, E.P., Koutinas, A.A., Soupioni, M. and Kanellaki, M. 1996. Immobilization of Yeast on Delignified Cellulosic Material for Low Temperatures Brewing. *J. Agric. Food. Chem.*, 44(2), 463-467.
8. Koutinas, A.A., Bakoyianis V., Argiriou, T., Kanellaki, M. and Voliotis, S. 1997. Qualitative Outline to Industrialize Alcohol Production by Catalytic Multi-Stage Fixed Bed Tower (MFBT) Bioreactor. *Appl. Biochem. Biotechnol.*, 66, 121-131.
9. Loukatos, P., Kiaris, M., Ligas, I., Bourgos, G., Kanellaki, M., Komaitis, M., and Koutinas, A. A. 2000. Continuous wine making by γ -alumina-supported biocatalyst. *Appl. Biochem. Biotechnol.* 89, 1-13.
10. Athanasiadis, I., Boskou, D., Kanellaki, M., Koutinas, A.A. 2001. Effect of Carbohydrate Substrate on Fermentation by Kefir Yeast Supported on Delignified Cellulosic Materials. *J. Agric. Food Chem.* 49(2), 658-663.
11. Bekatorou, A., Koutinas, A.A., Psarianos, K. and Kanellaki, M. 2001. Low Temperature Brewing by Freeze-Dried Immobilized Cells on Gluten Pellets. *J. Agric. Food Chem.*, 49(1), 373-377.
12. Kourkoutas, Y., Komaitis, M., Koutinas, A. A. and Kanellaki, M. 2001. Wine production using yeast immobilized on apple pieces at low and room temperatures. *J. Agric. Food Chem.*, 49(3), 1417-1425.
13. Athanasiadis, I., Boskou, D., Kanellaki, M., Kiosseoglou, V., Koutinas, A.A. 2002. Whey liquid waste of the dairy industry as raw material for potable alcohol production by kefir granules. *J. Agric Food Chem.*, 50(25), 7231-7234.
14. Bekatorou, A., Sarellas, A., Ternan, N.G., Mallouchos, A., Komaitis, M., Koutinas, A.A., Kanellaki, M. 2002. Low-temperature brewing using yeast immobilized on dried figs. *J. Agric. Food Chem.*, 50(25), 7249-7257.
15. Mallouchos, A., Komaitis, M., Koutinas, A.A., Kanellaki, M. 2002. Investigation of volatiles evolution during the alcoholic fermentation of grape must using free and immobilized cells with the help of solid phase microextraction (SPME) headspace sampling. *J. Agric. Food Chem.*, 50(13), 3840-3848.
16. Loukatos, P., Kanellaki, M., Komaitis, M., Athanasiadis, I., Koutinas, A.A. 2003. A new technological approach proposed for distillate production using immobilized cells. *J. Bioscience and Bioengineering*, 95(1), 35-39.
17. Paraskevopoulou, Athanasiadis, I., Kanellaki, M., Bekatorou, A., Blekas, G. and Kiosseoglou, V. 2003. Functional properties of single cell protein produced by kefir microflora. *Food Research International*, 36(5), 431-438.
18. Paraskevopoulou, A., Athanasiadis, I., Blekas, G., Koutinas, A.A., Kanellaki, M., Kiosseoglou, V. 2003. Influence of polysaccharide addition on stability of a cheese whey kefir-milk mixture. *Food Hydrocol.*, 17(5), 615-620.
19. Skountzou, P., Soupioni, M., Bekatorou, A., Kanellaki, M., Koutinas, A.A., Marchant, R., Banat, I.M. 2003. Lead(II) uptake during baker's yeast production by aerobic fermentation of molasses. *Process Biochem.*, 38(10), 1479-1482.
20. Kourkoutas, Y.; Xolias, V.; Kallis, M.; Koutinas, A.A.; Bezirtzoglou, E.; Kaliafas, A.; Kanellaki, M. 2005 *Lactobacillus casei* immobilization on fruit pieces for probiotic additive, fermented milk and lactic acid production. *Process Biochem.*, 40, 411-416.
21. Agouridis, N., Bekatorou, A., Nigam, P. and Kanellaki, M. 2005. Malolactic Fermentation in Wine with *Lactobacillus casei* Cells Immobilized on Delignified Cellulosic Material. *J. Agric. Food Chem.*, 53 (7), 2546-2551.
22. Plessas, S., Bekatorou, A., Kanellaki, M., Psarianos, C., Koutinas, A.A. 2005 Cells immobilized in a starch-gluten-milk matrix usable for food production. *Food Chem.*, 89(2), 175-179.
23. Proestos, C., Bakoyannis, A., Psarianos, C., Koutinas, A.A., Kanellaki, M., Komaitis, M. 2005. High Performance Liquid Chromatography analysis of phenolic substances in Greek wines. *Food Control*, 16(4), 319-323.
24. Kourkoutas, Y., Bosnea, L.A., Taboukos, S., Baras, C., Lambrou, D., Kanellaki, M. (2006) Probiotic cheese production using *L. casei* cells Immobilized on Fruit Pieces. *Journal of Dairy Science*, 89, 1439-1451.
25. Plessas, S.; Trantallidi, M.; Bekatorou, A.; Kanellaki, M.; Nigam P.; Koutinas, A. A. 2007. Immobilization of kefir and *Lactobacillus casei* on spent brewery grains for use in sourdough wheat bread making. *Food Chem.*, 105(1), 187-194.

26. Koutinas A.A., Athanasiadis I., Bekatorou A., Psarianos C., Kanellaki M., Agouridis N. and Blekas G. 2007. Kefir-yeast technology: Industrial scale-up of alcoholic fermentation of whey, promoted by raisin extracts, using kefir-yeast granular biomass. *Enzyme and Microbial Technology*, 41(5), 576-582.
27. Papapostolou, H., Bosnea, L.A., Kanellaki, M., and Koutinas, A.A. 2007. Convective Drying of the Thermotolerant *Kluyveromyces marxianus* at Relatively Low Temperatures and its Efficiency in Whey Fermentation. *Open Biotechnol. J.*, 1, 52-58
28. Agouridis, N., Kopsahelis, N., Plessas, S., Koutinas, A.A., Kanellaki, M. 2008. *Oenococcus oeni* cells immobilized on delignified cellulosic material for malolactic fermentation of wine. *Biores. Technol.* 99 (18), pp. 9017-9020
29. Dimitrellou, D., Kandylis, P., Kourkoutas, Y., Koutinas, A.A., Kanellaki, M. 2009 Evaluation of thermally-dried *Kluyveromyces marxianus* as baker's yeast *Food Chem.* 115 (2), pp. 691-696
30. Dimitrellou D., Y. Kourkoutas, A.A. Koutinas, M. Kanellaki. Thermally-dried immobilized kefir on casein as starter culture in dried whey cheese production. *Food Microbiology* 26 (2009) 809–820.
31. Kopsahelis Nikolaos, Aspasia Nisiotou, Yiannis Kourkoutas, Panayiotis Panas, George J.-E. Nychas, Maria Kanellaki. Molecular characterization and molasses fermentation performance of a wild yeast strain operating in an extremely wide temperature range. *Biores. Technol.* 100(20), 2009, 4854-4862.
32. Bosnea, L.A., Kourkoutas, Y., Albantaki, N., Tzia, C., Koutinas, A.A., Kanellaki, M. (2009). Functionality of freeze dried *L. Casei* cells immobilized on wheat grains. *LWT- Food Science and Technology*, 42(10), 1696-1702.

PATENTS

1. Koutinas A.A., Kanellaki, M., Voliotis, S., Kouinis, J., Kaliafas, A., Kana, K., Iconomou, L. 1993. «A method of Alcoholic Fermentation with the Catalyst Kissiris and gamma-alumina, after their Regeneration». Patent Corporation Treaty (PCT) with International Publication Number: WO 93/01298 and International Publication Date: 21 Jan. 1993. European Patent Office (EPO), Patent Nr. 0565647, Publication Date 20/10/93
2. Kanellaki, M., Koutinas, A. A., Kopsahelis, N., Bekatorou, A., Agouridis, N., Plessas, S. Industrial use of a novel immobilised yeast biocatalyst on brewer's spent grains for alcoholic fermentation for ethanol and alcoholic beverages production, 2006. Hellenic Industrial Property Organisation, patent number (11):1005439.
3. Kanellaki, M., Koutinas, A. A., Bosnea, L., Kourkoutas, Y., Industrial use of immobilized lactic acid bacteria in liquid and freeze-dried form for the production of dairy products. Hellenic Industrial Property Organisation, patent number 3 Αυγούστου 2008.
4. Koutinas, A.A., Kanellaki, M., Sypsas, V. Novel method for alcoholic drinks production in house scale with dry raw materials. Hellenic Industrial Property Organisation, patent number: 1005818 (14/02/2008).

FOOD BIOTECHNOLOGY GROUP

The Food Biotechnology Group of the Dept. of Chemistry, UP, specializes on fermentation technology (submerged & solid state), fermented food production, agro-industrial waste utilization, industrial bioreactor design. Among the Group's achievements are the isolation of extremophiles, the development of alcoholic fermentation promoters and solid carriers for cell immobilization, the production of starter cultures and novel foods with probiotic and functional properties, the development of kefir and cheese whey utilization technologies, the installation and operation of 100-100.000 L industrial bioreactors, etc. The Group has supervised a large number of Ph.D. and MSc theses on food biotechnology research subjects. Since 1997 the Group coordinates the **International Postgraduate Programme MSc Food Biotechnology**, in cooperation with the Universities of Ioannina (Greece) and Ulster (UK), leading to excellent common scientific cooperation, common publication of research papers, award of scholarships, and promotion of professional development of Greek graduates.

EQUIPMENT

The Food Biotechnology Group administrates laboratories specifying in both food chemistry and biotechnology. The available major equipment includes: GC-MS (with SPME sampling equipment) (Shimadzu); X-ray powder diffractometer (Enraf Nonius); Atomic adsorption spectrometer (Shimadzu);

HPLC-RID (Shimadzu); GC-FID (3 instruments) (Shimadzu); Freeze dryers (3 instruments) (Labconco & LabTech); Spray dryer (Buchi); PCR Thermal Cycler (Thermo Electron Corp.); Vertical laminar airflow cabinet (BSC-EN); Kjeldahl & steam distillation apparatuses (Velp scientifica)

INTERNATIONAL COOPERATION

The Group has developed national and international cooperation in the frame of common: a) scientific research, b) research proposal submission and coordination, c) guidance of postgraduate theses, d) coordination of international forums and conferences, e) educational events, f) laboratory training, etc. Specifically:

- University of Ulster (UK), School of Biomedical Sciences (Prof. R. Marchant, Prof. I. M. Banat & Dr. P. Nigam)
- National Institute for Interdisciplinary Science and Technology (India), Biotechnology Division (Prof. A. Pandey)
- Imperial College London (UK), Dept. of Chemical Engineering and Chemical Technology, Centre for Process Systems Engineering (Dr A. Mantalaris & Prof. S. Pistikopoulos)
- University of Hannover (Germany), Dept. of Natural Sciences, Institute of Food Chemistry (Prof. R. G. Berger)
- University of Modena and Reggio Emilia (Italy), Dept. of Agricultural Sciences (Prof. P. Giudici)
- University Blaise-Pascal (France), Dept. of Chemical and Biochemical Engineering, LGCB (Prof. C. Larroche)
- University of Mersin (Turkey), Dept. of Environmental Engineering (Assist. Prof. A. Unyayar)
- University of Manchester (UK), School of Chemical Engineering and Analytical Science & Satake Centre for Grain Process Engineering (Prof. C. Webb)
- University of Reading (UK), Dept. Of Food Biosciences (Dr. D. Charalampopoulos)
- University of Belgrade (Serbia), Faculty of Agriculture, Institute of Food Technology and Biochemistry (Professor Viktor Nedovic).
- University of Ioannina (Greece), Dept. of Chemistry (Prof. M. Kontominas)
- Agricultural University of Athens (Greece), Dept. of Food Science and Technology (Prof. M. Komaitis)
- Democritus University of Thrace (Greece) , Dept. of Molecular Biology & Genetics and Dept. of Agricultural Development (Prof. E. Bezirtzoglou, Dr. Y. Kourkoutas & Dr. S. Plessas)
- National Technical University of Athens (Greece), School of Chemical Engineering (Prof. C. Tzia)
- University of Thessaloniki (Greece), Dept. of Chemistry (Ass. Prof. G. Blekas, Asoc. Prof. D. Kioseoglou & Dr. A. Paraskevopoulou)

CONTACT DETAILS

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LINKS

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<http://www.ifibiop.org/>

<http://www.adsa.org/>