Pigments produced by the bacteria belonging to the genus Arthrobacter
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Pigments produced by the bacteria belonging to the genus *Arthrobacter*

**Sutthiwong N.**, **Caro Y.**, **Fouillaud M.**, **Laurent P.**, **Valla A.**, **Dufosse L.**

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**Introduction**

For several decades, pigments have been used as a taxonomic tool for the identification and classification of bacteria. Nowadays, pigment producing microorganisms attract wide interest in many scientific disciplines because of their biotechnological potential.

The growing concern in microbial pigments because of factors such as production independent from seasons and geographical conditions, novel combinations of microorganisms and pigments that can be extracted from the biomass or the culture medium are being evaluated.

**Carotenoids**

Two psychrophilic bacteria, *Arthrobacter glaciicola* and *Arthrobacter flavus* sp. nov., have been discovered as yellow pigments producers. Their pigments were characterized as three C30-carotenoids with molecular formula C30H40O. More recently, *Arthrobacter anitarsis*, one of the major bacterial species found at the surface of smear-ringed cheeses, has been reported as a yellow pigment producer, pigment which was tentatively identified as carotenoids. Furthermore, the carotenoids excreted by this strain may also belong to the C50 subfamily.

**Riboflavin**

Another strain which produces a blue pigment related to indigoidine is *Arthrobacter crysophacus*, although colonies of this *Arthrobacter* appear brilliant green in color. The strain *Arthrobacter oxydans* has also been reported that it produces the blue pigment which is also related to indigoidine.

**Porphyrins**

Many bacteria in the genus *Arthrobacter* produce red pigment porphyrins. A compound belonging to the family of red extracellular pigments porphyrin was isolated in *A. globiformis*, *A. photogranum* and *A. aureus* and identified as coproporphyrin III, C21H26N4O4 (Fig. 5). After forms of porphyrin was also described from pigment excreted by *A. hyalinus*. This pigment was identified as uroporphyrin, C20H20N4O (Fig. 6).

**Conclusions**

Pigments produced by microorganisms gain interest from the scientific community not only as a taxonomic tool to identify and classify the microorganisms but also for a commercial purpose. The utilization of natural pigments in manufacturing has been increasing since the nineties due to the consumer awareness and the toxicity problems linked to synthetic pigments. Microorganisms seem to be a reasonable choice for colorant production due to biotechnological advantages e.g. production regardless of season and geographical conditions; controllable and predictable yield. The genus *Arthrobacter* is one among the most diverse microbial groups which have been found to produce pigments. Most of bacteria in this genus produce a range of pigments with orange, yellow, blue, green or red hues. At the present time, 80 species in this genus have been accepted by taxonomists. However, the purification and characterization of pigments produced by bacteria belonging to the genus *Arthrobacter* have not been frequently conducted up to the complete description of the chemical structures and the role(s) of pigments in these strains.

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**Indigoidine**

Brilliant blue in color and water-insoluble pigments produced by *Arthrobacter atrocyaneus* and *Arthrobacter polychromogenes* were identified as indigoidine and its derivatives (Fig. 3).

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**Indochrome**

Apart from indigoidine, other chromophores of the water-soluble pigments produced by *A. atrocyaneus* and *A. polychromogenes* were identified as indochromes with chemical formula C49H72N2O4 (Fig. 4). These pigments were released into the culture liquid only by indigoidine-producing bacteria.
Abstract
Since several decades, pigments have been used as a taxonomic tool for the identification and classification of bacteria. Nowadays, pigment producing microorganisms have been also widely interested in scientific disciplines because of their biotechnological potential. With the growing interest in microbial pigments because of factors such as production regardless of season and geographical conditions, novel microorganisms which their pigments can be extracted are being evaluated. In the nature, a numerous number of microorganisms e.g. yeast, fungi, algae and bacteria produce pigments. The genus *Arthrobacter* is one among diverse microorganisms which has been found to produce pigments. Most of bacteria in this genus produce a range of pigments. Several previous studies show that pigments produced by bacteria belonging to the genus *Arthrobacter* have various hues depending on the chromophore which is present, e.g. yellow by carotenoid and riboflavin, green and blue by indigoidine and indochrome, and red by porphyrins and carotenoids. Since long time numerous strains in this genus have been reported that their colonies are colored; however, the purification and characterization of their pigments were not frequently conducted until well know chemical structures and role in these strains. Consequently, a study of pigments produced by the genus *Arthrobacter* may be worthy to play attention for discovering a novel source of natural colourants.

References
7th International Congress on Pigments in Food

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### 7th International Congress on Pigments in Food

18-21 June 2013, Novara, Italy

**SCIENTIFIC PROGRAM**

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Food Biotechnology Department, Instituto de la Grasa (CSIC), Sevilla, Spain |
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1 Institute of Sciences of Food Production, CNR, Lecce, Italy; 2 Department of Sciences and Technologies for Agriculture, Forestry, Nature and Energy, Tuscia University, Viterbo, Italy |
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Competence Center for Viticulture & Enology, Neustadt an der Weinstraße, Germany. |
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1 Department of Plant Biology and Ecology, University of Basque Country, UPV/EHU, Bilbao, Spain |
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Food Biotechnology Department, Instituto de la Grasa (CSIC), Sevilla, Spain. |
(Siran Vocational School, Gumushane University, Gumushane, Turkey) |
| 12.40 - 13.00| OXIDATION ROUTES FOR BETACYANINS                                               | Wybraniec S.1, Szot D.1, Nemzer B.2, Pietrzkowski Z.3  
1Department of Analytical Chemistry, Cracow University of Technology, Cracow, Poland; 2Chemistry Research, FutureCeuticals Inc., Momence, IL, USA; 3Applied BioClinical Inc., Irvine, CA, USA. |
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Christaki E.,
Laboratory of Nutrition, Faculty of Veterinary Medicine, Aristotle University of Thessaloniki, Thessaloniki, Greece.

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CRIAcq Research Centre, University of Naples “Federico II”, Portici, Italy

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Caro Y., Fouillaud M., Laurent P., Dufossé L.
Laboratoire de Chimie des Substances Naturelles et des Sciences des Aliments, Université de la Réunion, Sainte-Clotilde, Ile de la Réunion, France

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Kermasha S., Borgomano S.
Department of Food Science and Agricultural Chemistry, McGill University, Ste-Anne de Bellevue, Canada

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Department of Food Science, University of Campinas, Campinas, Brazil. |
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\(^1\) J. Mayer USDA Human Nutrition Research Center on Aging at Tufts University, Boston, MA;  
\(^2\) Food Colour & Quality Laboratory, Department of Nutrition and Food Science, Universidad de Sevilla, Sevilla, Spain;  
\(^3\) Department of Nutritional Science, Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy, Tufts University, Boston, MA. |
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Department of Pharmaceutical Sciences, University of Piemonte Orientale “A. Avogadro”, Novara, Italy. |
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The Organizing Committee expresses sincere thanks to