

Special Issue dedicated to the Amazonia
Journal of Brazilian Chemical Society



Editor

Angelo da Cunha Pinto

(Universidade Federal do Rio de Janeiro, Brazil)

Guest Editors

Carol H. Collins

(Universidade Estadual de Campinas, Brazil)

Valdir Florêncio da Veiga Junior

(Universidade Federal do Amazonas, Brazil)

JOURNAL OF THE BRAZILIAN CHEMICAL SOCIETY

Editors

Angelo da Cunha Pinto
Universidade Federal do Rio de Janeiro
Brazil

Jailson B. de Andrade (coordinator)
Universidade Federal da Bahia
Brazil

Jaísa Fernandes Soares
Universidade Federal do Paraná
Brazil

Luiz Carlos Dias
Universidade Estadual de Campinas
Brazil

Roberto M. Torresi
Universidade de São Paulo
Brazil

Watson Loh
Universidade Estadual de Campinas
Brazil

Associate Editors

Adriano L. Monteiro
Universidade Federal do Rio Grande do Sul
Brazil

Francisco Radler de Aquino Neto
Universidade Federal do Rio de Janeiro
Brazil

Joaquim A. Nóbrega
Universidade Federal de São Carlos
Brazil

Koiti Araki
Universidade de São Paulo
Brazil

Marília O. F. Goulart
Universidade Federal de Alagoas
Brazil

Maysa Furlan
Universidade Estadual Paulista
Brazil

Ricardo Longo
Universidade Federal de Pernambuco
Brazil

Editorial Advisory Board

Alberto Nuñez Sellés
Center of Pharmaceutical Chemistry
Cuba

C. N. R. Rao
J. N. C. for Advanced Scientific Research
India

Eusébio Juaristi
Centro de Investigación y de Estudios Avanzados
del Instituto Politécnico Nacional - Mexico

Fernando Galembeck
Universidade Estadual de Campinas
Brazil

Henrique E. Toma
Universidade de São Paulo
Brazil

Jean-Marie Lehn
Université Louis Pasteur
France

José Luiz F. Costa Lima
Universidade do Porto
Portugal

Miguel de la Guardia
Universidad de Valencia
Spain

Otto Richard Gottlieb
Fundação Instituto Oswaldo Cruz
Brazil

Richard G. Weiss
Georgetown University
USA

Roberto Sanchez-Delgado
Brooklyn College
USA

Editorial Manager: Angela Ramalho Custodio

Editorial Manager Assistants: Sérgio Lontra Vieira, Maria Cristina Andreazza Costa,
Aloísia Laura Moretto and Aya Hase

Founding Editor: Eduardo M. A. Peixoto

Former Editors: Armi W. da Nóbrega, Gerardo G. B. de Souza, Jaswant R. Mahajan, Fernando Galembeck, Henrique E. Toma, Luis A. Avaca, Luiz Carlos G. Freitas, Marco-Aurélio De Paoli, Maria D. Vargas, Oswaldo L. Alves, Miguel Jafellicci Jr., Ronaldo A. Pilli.

Former members of the Advisory Board: Giuseppe Cilento[†], Jaswant R. Mahajan, Linus Pauling[†], Hitoshi Ohtaki, Isabella Karle, Klaus Hafner, Kozo Kuchitsu, Russell A. Bonham, Vicente G. Toscano, Jerome Karle, Henry Taube[†], Alejandro J Arvia, Clayton H. Heathcock, G. Jeffery Leigh and José Manuel Riveros.

Former Editorial Manager: Elizabeth Magalhães

The *Journal of the Brazilian Chemical Society* is published eight issues per year by the Sociedade Brasileira de Química
SBQ Periodicals Coordinator: Vanderlan S. Bolzani

Editorial and Publishing Office:

Instituto de Química, UNICAMP, CP 6154, 13083-970 Campinas - SP, Brazil
Tel/Fax: +55 19 3521-3151; E-mail: office@jbcs.sbq.org.br

Subscriptions and Advertising Office:

Sociedade Brasileira de Química, CP 26037, 05513-970 São Paulo - SP, Brazil
Tel: +55 11 3032-2299; Fax: +55 11 3814-3602; E-mail: sbqsp@iq.usp.br

The *Journal of the Brazilian Chemical Society* serves its readers as a forum for information related to the advancement of Chemistry. The *Journal* is devoted to the publication of research papers in all fields of Chemistry, except education, philosophy and history of Chemistry

Information for authors: Full details of how to submit material for publication in the *Journal of the Brazilian Chemical Society* are given in the link **Instructions for Authors** <http://jbcs.sbq.org.br>

Galley proofs are sent by the Editorial Office to the author who submitted the manuscript. Proofs should be checked and returned as soon as possible (preferably within 48 hours)

Subscription Rates - 2009. Members of the Sociedade Brasileira de Química: R\$90,00 (Brazil) and US\$112 (other countries). Non-members: R\$217,00 (Brazil), US\$112 (Latin America) and US\$193 (other countries). Institutions: R\$217,00 (Brazil) and US\$300 (other countries). See also World Wide Web <http://jbcs.sbq.org.br/about/subscription.php>

Back issues. Back issues of all previously published volumes are available directly from the Subscriptions Office

Copyright © 2009 Sociedade Brasileira de Química

It is a condition for publication that manuscripts submitted to this journal have not yet been published and will not be simultaneously submitted or published elsewhere. By submitting a manuscript, the authors agree that the copyright for their article is transferred to the Sociedade Brasileira de Química (SBQ) if and when the article is accepted for publication. The copyright covers the exclusive rights to reproduce and distribute articles, including reprints, photographic reproductions, microform or any other reproductions of a similar nature, including translations. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, whether electronic, electrostatic or mechanical, nor by photocopying, recording, magnetic tape or otherwise, without written permission from the copyright holder.

While every effort is made by the SBQ, editors and editorial board to see that no inaccurate or misleading data, opinions or statements appear in this journal, they wish to make it clear that the contents of the articles and advertisements published herein are the sole responsibility of the contributors or advertisers concerned. Accordingly, the SBQ, the editorial board and editors and their respective employees, officers and agents accept no responsibility or liability whatsoever for the consequences of any such inaccurate or misleading data, opinion or statement.

Photocopying information for users in the USA. The Item-Fee Code for this publication indicates that authorization to photocopy items for internal or personal use is granted by the copyright holder for libraries and other users registered with the Copyright Clearance Center (CCC). Transactional Reporting Service provided the stated fee for copying beyond that permitted by Section 107 and 108 of the United States Copyright Law is paid. The appropriate remittance of \$ 6.00 per copy per article is paid directly to the Copyright Clearance Center Inc., 222 Rosewood Drive, Danvers, MA 01923, USA

Permission for other use. The copyright owner's consent does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific written permission must be obtained from the Publisher for such copying

The Item-Fee Code for this publication is: 0103-5053 \$6.00 + 0.00

Printed on acid-free paper

Indexed in the following databases: Science Citation Index®, Science Citation Index expanded (SciSearch®), ISI Alerting Services, Chemical Abstracts – CA Plus, Chemistry Citation Index®, Current Contents®/Physical, Chemical and Earth Sciences, SciELO and SCOPUS

Financial support:



Ministério
da Educação

Ministério da
Ciência e Tecnologia



Printed in Brazil

Desktop Publishing: Hermano - Phone: +55 11 5571-8937

Printed by: Print Master - Phone: +55 19 3223-9707