

Journal of Scientific & Industrial Research

Editorial Board

Dr G.S. Mukherjee

Additional Director
Head HRD and Technical
Coordinator
DESIDOC, Metcalfe House,
Delhi – 110 054
Email: gs_mukherjee@rediffmail.com

Dr PC Angelo

Director,
Metal Testing & Research Centre
PSG College of Technology
Coimbatore – 641 004
E-mail: angelo_psg@yahoo.com

Prof Mihir Kanti Chaudhuri

Vice Chancellor, Tezpur
University
Napaam, Tezpur
Sonitpur, Assam – 784 028
Email: mkc@tezu.ernet.in

Dr J. P. Tamang

Dean, School of Life Sciences
Professor, Department of
Microbiology
Sikkim Central University
Tadong, Gangtok – 737 102
E-mail: jyoti_tamang@hotmail.com

Prof Amartya Mukhopadhyay

Department of Metallurgical
Engineering & Material Science
IIT Bombay, Powai,
Mumbai – 400076
E-mail: amartya.28nov@gmail.com

Prof T Sundararajan

Department of Mechanical
Engineering
IIT Madras
Chennai – 600036
E-mail: tsundar@iitm.ac.in

Prof. J. Chattopadhyaya

Program of Chemical Biology,
Department of Cell and Molecular
Biology
Biomedical Centre,
Uppsala University
SE-75123 Uppsala Sweden.
E-mail: jyoti@boc.uu.se

Prof. Grace T. R Lin

Institute of Management of
Technology, No. 1001
Ta Hsueh Road, National
Chiao Tung University
HsinChu City, Taiwan
Email: gtrl@faculty.nctu.edu.tw

Dr Sudhakar Mahajanam

ConocoPhillips Co 248 Geo
Science Building
Bartlesville, OK74004, USA
Email: sudhakar.p.mahajanam@
conocophillips.com

Dr R A Osornio

HSP digital-CA Mecatronica,
Facultad de Ingenieria Campus
San Juan Del Rio,
Universidad Autonoma de Queretaro,
San Juan Del Rio, Queretaro,
Mexico
E-mail: raosornio@hspdigital.org

Dr Rer Nat Hesham A El Ensashy

Institute of Bio products
Development
University Technology Malaysia,
81310 Johor Bahru, Johor, Malaysia
E-mail: henshasy@ibd.utm.my

Dr Ajay K Ray

Professor and Chair
Department of Chemical and
Biochemical Engineering
Thompson Engineering Building
Western University
London, ONN6A5B9. Canada
Email: aray@eng.uwo.ca

Director Dr. Ranjana Aggarwal, CSIR-NISCAIR (Ex-Officio)

Editor: Dr Sanjay Sengupta

Published by National Institute of Science Communication and Information Resources, Dr K S Krishnan Marg, New Delhi – 110 012
Phone: 25841143, 25846301; Fax: (0091)-11-25847062; E-mail: jsir@niscair.res.in; Website: www.niscair.res.in

The *Journal of Scientific & Industrial Research* is issued monthly.

The Institute assumes no responsibility for the statements and opinions advanced by contributors. The editorial staff in their work of examining papers received for publication is assisted, in an honorary capacity, by a large number of distinguished scientists working in various parts of India and abroad.

Communications regarding contributions for publication in the journal and books for review should be addressed to the Editor, Journal of Scientific & Industrial Research, National Institute of Science Communication and Information Resources, Dr K S Krishnan Marg, New Delhi 110 012, India.

Annual Subscription: ₹ 3600.00 \$ 650.00

Single Copy: ₹ 360.00 \$ 65.00

(*inclusive of first class mail)

Correspondence regarding subscriptions and advertisements should be addressed to the Sales & Distribution Officer, National Institute of Science Communication and Information Resources, Dr K S Krishnan Marg, New Delhi – 110 012, India ("Subscription Complaint" No. 25843359).

Phones: 25843359, 25846301, 25846303-7; **Fax:** (0091)-11-25847062, **E-mail:** sales@niscair.res.in

Payments in respect of subscriptions and advertisements may be made demand draft/IPO/ECS/NEFT/RTGS payable to NISCAIR, New Delhi. The following detail may be used for ECS/NEFT/ RTGS transactions with NISCAIR.

Bank name: Syndicate Bank Address: Pusa Campus, IARI, New Delhi 110 012, India Branch: Pusa Campus, IARI, New Delhi

Account No.: 90292160000079 Account Name: NISCAIR, New Delhi 110 012 IFSC Code: SYNB0009029

MICR Code: 110025041 Branch code: 9029 SWIFT code: SYNBINBB019

Claims for missing numbers of the journal will be allowed only if received within three months of the date of issue of the journal plus the time normally required for postal delivery of the journal and the claim.

© 2019. The Council of Scientific & Industrial Research, New Delhi 110 001.