

PROCEEDINGS OF THE
SECOND WORLD CONGRESS ON
DESALINATION AND WATER
RE-USE

NOVEMBER 17-22, 1985
BERMUDA

VOLUME 2

SESSION IV: DISTILLATION TECHNOLOGY
V: MATERIALS AND CORROSION
VI: DESALINATION PRACTICE



Organized by the
INTERNATIONAL DESALINATION ASSOCIATION (IDA)

Cosponsored by the
EUROPEAN FEDERATION OF CHEMICAL ENGINEERING
Working Party on Fresh Water from the Sea

X. LU, C. GAO and X. SUN Reinforced and dry polysulfonamide membranes	207
Y. MIMURA, S. TANIGUCHI and E. TATSUMURA MASHIMA How to obtain highest plant efficiency for reverse osmosis desalination plant	219

III CHEMICALS IN DESALINATION

D. BARBA, V. BRANDANI, and G. DI GIACOMO CaSO ₄ scale conditions of membranes predicted by a multi-ion thermodynamic model	227
M.P.C. WEIJNEN and G.M. VAN ROSMALEN The influence of various polyelectrolytes on the precipitation of gypsum	239
Z. AMJAD Applications of antiscalants to control calcium sulfate scaling in reverse osmosis systems	263
A.L. SMITH, D.P. LOGAN, H.E. NEHUS and M.L. DELITSKY Elimination of mineral acid dosing to control water formed scale in brackish water reverse osmosis systems	277
K.C. COOPER, L.G. HANLON and R.E. TALBOT An operating philosophy to optimize the output, plant life and economy of MSF plants operating at high temperatures	291
J.C. BERNARD and E. DEMOLINS Scale control additive - practical experiences in MSF plants	301
F. BUTT, F. RAHMAN, A. AL-ABDALLAH, H. AL-ZAHRANI, A. MAADHAH AND M. AMIN Field trials of hybrid acid-additive treatment for control of scale in MSF plants	307
D.P. LOGAN and S. KIMURA Control of gypsum scale on reverse osmosis membranes	321
R. ZANNONI, F. FANTINI, M. HARUNI, T. ABU IHWEIG and G. BOARI Reverse osmosis desulphation pretreatment: new prototype application	333
M. WILF and P. GLUECKSTERN Restoration of commercial reverse osmosis membranes under field conditions	343
A. KAJI and M. MURANO Membrane for ethanol-water separation - water selective membrane	351
D.P. LOGAN and K. KURODA Improved high temperature MSF evaporator operation for potable water production	361
I. RESINI, G. COLIVA, A. DE MATO and R. LUCENTI 4x6 MIGPD plus 1x1 MIGPD (acid) plants - two years' operation results	377

VOL. 2 PROCEEDINGS (VOL. 55 DESALINATION)

IV DISTILLATION TECHNOLOGY

A.M. AL MUDAIHEEM and H. MIYAMURA Construction and commissioning of Al Jobail Phase II desalination plant	1
--	---

U. FISHER, A. AVIRAM and A. GENDEL Ashdod multi-effect low temperature desalination plant report on year of operation	13
M. LUCAS and F. MURAT Desalination by mechanical vapour compression: operational results after one year operation of the Flamanville unit - comparison with other desalination processes by evaporation	33
N. NADA, D. KHUMAYYIS and M. AL HUSSAIN Economical evaluation of Alkhubar phase two 50 MIGPD at three different modes of operation	43
B.A. CRUL and P.R. BOM New aspects in solar powered seawater distillation	55
J. CORTÉS and F. CANTERA Basic parameters of design on a VC-VTE process with high ER	69
A. FURUKI, K. HAMANAKA, M. TATSUMOTO and S. INOHARA Automatic control system of MSF process (Ascode®)	77
D.M. KHAMIS FAREIGH and S. ARAZZINI Description and mathematical model of a large MSF desalination plant in SCADA configuration	91
M.H.A. EL-SAIE, M.F. FARRAG, and M.H. ERFAN Computer supervisory control of MSF evaporator	107
H.T. EL-DESSOUKY and G.M.R. ASSASSA Computer simulation of the horizontal falling film desalination plant	119
M.M. HILAL and M.A. MARWAN Design equations for a new set up of sluice gates to stabilize inter-stage brine flow	139
A.M. MUBARAK and H.T. EL-DESSOUKY Design of waste heat boiler for desalination-gas turbine co-generation plant	145
T.J. RABAS An improved MSF condenser design	169
G. MIGLIORINI, B. FUMAGALLI and S. ARAZZINI Theoretical approach to MSF stages efficiency calculation	185
H.T. EL-DESSOUKY and T.A. KHALIFA Scale formation and its effect on the performance of once through MSF plant	199

V MATERIALS AND CORROSION

R. CIGNA, L. GIULIANI and G. GUSMANO Continuous corrosion monitoring in desalination plants	219
T. HODGKIESS, N.K. NG and P. ARGYROPOULOS The corrosion behaviour of a number of materials exposed to bromine-containing environments	229

S. NORDIN, B. ERICSSON and B. WALLEN Optimization of high-pressure piping in reverse osmosis plants	247
J.W. OLDFIELD and B. TODD The use of stainless steels and related alloys in reverse osmosis desalination plants	261
M. PÖTZSCHKE, M.B. ROCKEL and G. RUDOLPH The effect of iron (pick-up) on seawater corrosion properties of welded CuNi10Fe steel compounds	281
U. ROHLFS and H.-D. SCHULZE Possibilities of corrosion prevention and removal in seawater exposed structures and desalination plants	283
H.-D. SCHULZE, U. ROHLFS and K. THIES Enhancement of availability through the early detection of damage in desalination plants	297
V. CANETTA and N.M. VALOTA MSF desalination plants - copper alloy tubes: their economic aspects for overall cost production	307

VI DESALINATION PRACTICE

M. AL-ARRAYEDH, B. ERICSSON and M. OHTANI Construction and operation of 46,000 m ³ /day reverse osmosis desalination plant, Ra's Abu Jarjur, Bahrain	319
P.J. DE MOEL, R.F.M. DE GIER and G. ONDERDELINDEN Design of the 50,000 m ³ /day treatment plants for Qasim S.A. desalination of brackish water at 99% recovery	343
M. AL-SOFI, R.D. PETERSON, D.L. MOEN, Y. SOEJIMA and H. SAWADA Thermal performance of 10x5.2 MIGD MSF plants, Al Jobail phase II	357
N.M. WADE, R. HEATON and D.G. BOULTER Desalination and water re-use: comparison of MSF and RO in dual purpose power and water plants	373
K. THIES, U. ROHLFS and H.-D. SCHULZE Enhancement of the availability of desalination plants by means of in-service inspections	387
R.P. BIRCH, M. AL-ARRAYEDH and B. HALLMANS Bahrain's fresh groundwater situation and the investigations into using Bahrain's brackish water resources as a feedwater for the reverse osmosis desalination programme	397
H. BOEHMER and F.J. GLAZE Better MSF plant performance by avoiding tube fouling and debris	429
B. ERICSSON and B. HALLMANS A comparative study of the economics of RO and MSF in the Middle East	441
G. FECHNER and R. PILLKAHN Use of variable speed pumps for MSF and RO plants	461
P. GLUECKSTERN, M. WILF, J. ETGAR and J. RICKLIS Use of microprocessors for control, data acquisition and on-line performance evaluation in a reverse osmosis plant	469
M. KISHI, K. MATSUMOTO, Y. TAKEUCHI and K. HATTORI Development of flow model for weir type orifice	481

S.A. KRESHMAN Seawater intakes for desalination plants in Libyan	493
L. LIBERTI, R. PASSINO, M. SANTORI and G. BOARI Technical and economic trends of seawater desalting in the 90's	503
T.J. RABAS The effect of tubeside maldistribution on the thermal performance of condensers used in MSF distillation plants	515
F.E. STONE and A.N. ROGERS A projected world market for seawater desalination equipment	529
H. BOEHMER and F.J. GLAZE Debris separators and filters for different desalination systems	559
C.D. HORNBERG Analysis of desalination alternates for phosphoric acid plant in Tunisia	571
B. TEISLEV Small on-shore desalination plants	589

VOL. 3 PROCEEDINGS (VOL. 56 DESALINATION)

VII WATER RE-USE

H.H. SEPHTON Process sequence for using saline water as power plant coolant	1
P.S. CARTWRIGHT Membranes separations technology for industrial effluent treatment A review	17
N. HASBANI Basic design and economic evaluation of brine recycling by vapor compression and of wastewater reclamation by RO and vapor compression for re-use	37
C. BOWLER, S.H. GREENHALGH and M.S. BRENJI Process design of a 30,000 m ³ /d advanced water re-use facility for Jeddah, Saudi Arabia	47
H. KOHLI, D. EMMERMANN, R. KADAJ and H. SAID Hybrid desalting technology maximizes recovery	61
O.O. HART and R.C. SQUIRES The role of membrane technology in industrial water and wastewater management	69
M.R. BREWSTER and O.K. BUROS The use of non-conventional water resource alternatives in water short areas	89
J.C. SCHIPPERS, H.C. FOLMER, J. VERDOUW and H.J. SCHEERMAN Reverse osmosis for the treatment of surface water	109
H. ZHANG, X. ZHENG and J. LIN The application of MEMS flash in re-use of alkaline waste water	121
C. BOWLER and S. GREENHALGH Water reclamation from sewage using traditional techniques - some large scale examples	131
K. IMASU Wastewater recycle in the plating industry using brackish water reverse osmosis elements	137