

# THE INDUSTRIAL CHYMIST

## HITTING THE BOTTLE

B. J. Luberoff, Ph.D.

How often have you noticed drug store products whose containers cost more than their contents? This relationship seems to be necessary to convince the customer that the contents are good. On the other hand, when transfer of material occurs inside the company, how often does the container give the impression that its contents are valueless? How often do samples come into the analytical lab in loosely stoppered, dirty bottles that are only a tenth full? Both of these extremes seem to merit more attention than they have been getting. The simple fact of the matter is that a container should do more than simply contain material. The question is, what "more" is a reasonable minimum?

A somewhat unhappy situation was encountered by a driver who was sent to pick up a carboy of a chlorinated kerosine. Someone had forgotten to blow out the coproduct HCl, and its evolution caused the poor man to drive 400 miles, in the dead of winter, with all his windows open. Containers should at least contain! Liquid containers should be selected to withstand the maximum foreseeable pressure. The implication is that some foresight is called for. It is amazing how fast the composition of a bottle of light hydrocarbon mixture can change when the sun occasionally rakes the reagent shelf on which it stands. And, astounding results occur when a liquid "grab" sample taken into a pressure bottle *half* vaporizes before analysis. The only solution I've found is to vaporize *all* the sample before analysis.

And then there is corrosion with resulting contamination by the container itself. We had just completed research on a process for a light ester and I was eager to show a

sample at the review committee meeting. I hastily bottled some of the sparkling, clear liquid and put it in my jacket pocket so that I could put it on the conference table at the most dramatic moment. Imagine my chagrin when the moment arrived, and I pulled out a leaking sample rendered quite turbid by dissolution of the cap liner. Since that time, we line *all* of our caps with teflon film.

A recent addition to the Chymist's stable of containers is the vial capped with a rubber septum, which permits transfer of material *via* hypodermic syringe. These septa, though handy, have presented us with a number of interesting problems. In one case, a chap insisted that he had made benzene from ethylene, only to find that the septum had previously "seen" a benzene atmosphere and had adsorbed enough to contaminate the gas he had placed in the vial. We also found a fair amount of vapor leakage through these septa and have taken to adding enough mercury to cover the septum when the bottle is inverted. This is why you'll see so many upside down bottles in our lab.

Although it is really not too difficult to containerize samples properly in the lab, in the field people seem to lack both proper appreciation of the problem as well as apparatus to solve it. Thus, as mentioned above, samples come delivered in all manner of makeshift containers, and if they are not dirty, they have been washed with water ... but not dried. Buy a case of containers, for goodness sake. They're cheaper than a bum assay.

Then there is the ubiquitous problem of contamination by material that has been hung up in the sample line. How is one to dis-

tinguish air that is in the process stream from the air that crept in during sampling? This problem has caused many to replace evacuated sample containers with double-ended units, which can be swept with the process gas. Glass sweep containers, properly handled, don't blow up either. (This means close the *inlet* side first.) But sweep containers still don't solve the problem, because the sweep volume must be sufficient to replace the volume of the container at least ten or preferably twenty times. Thus, a sample line flow of 100 cc/min should purge a 100-cc sample bomb for at least 10 min. Furthermore, some provision must be made for carrying off the liter or so of gas that is bled. Without foresight, it becomes too easy not to sweep at all. So much then for the container itself. Make sure it will hold the sample and not allow it to escape. Select the container so that it will not contaminate the sample, and finally, make sure that what is in the container is thoroughly representative of the material being sampled.

And so the sample arrives at its destination, but nobody knows what it is because the label is illegible, incomplete, or in the basket. It doesn't take that long to put all the necessary information on the label and by "All" is meant, not only the identity of the sample, but its origin, the initials of the sampler, and the date. (It's good practice to initial and date reagent bottles when you first open them, too.) It is rare that this information cannot be ball pointed or typed on a gummed label, and protected with transparent tape. Pencil, wax, or lead rubs off, ink washes off, and string tags fall off.

Certainly, precautionary information should be on the label too. I

## There when you need them...

are the annual 700 pages of data published quarterly in the **Journal of Chemical & Engineering Data**. This American Chemical Society journal is especially valuable in light of today's new instrumentation.

You'll find four clearly defined areas in JC & ED. They are:

☐ Experimental data relating to pure compounds of mixtures covering a range of states.

☐ Manuscripts based on published experimental information, which make tangible contributions through the reorganization or systematic presentation of such data... or which set forth a well documented method of prediction of properties as a function of state.

☐ Experimental data which aid in the identification or utilization of new organic or inorganic compounds.

☐ Papers relating primarily to newly developed or novel synthesis or organic compounds and their properties.

*Sending for a subscription to the JOURNAL OF CHEMICAL & ENGINEERING DATA is so much easier than searching for data deposited in archives. Just fill in and return the form below. We'll do the rest.*

Note: Subscriptions at ACS Member Rates are for personal use only.

**American Chemical Society**  
1155 Sixteenth Street, N.W.  
Washington, D.C. 20036

Please enter my subscription to **The Journal of Chemical & Engineering Data** at the rates checked below.

ACS Members:

- ☐ U.S. \$15  
☐ Canada, PUAS \$18  
☐ Other Nations \$18.50

Nonmembers:

- ☐ U.S. \$30  
☐ Canada, PUAS \$33  
☐ Other Nations \$33.50

- ☐ Bill me    ☐ Bill employer  
☐ Payment enclosed  
(Payable to American Chemical Society)

Name

Title

Employer

Address: ☐ Home ☐ Business

City  State/Country  Zip

Nature of employer's business?

- ☐ Manufacturing or processing  
☐ Academic  
☐ Government  
☐ Other

(Please indicate)

- ☐ I am an ACS member  
☐ I am not an ACS member

Payment must be made in U.S. currency, by international money order, UNESCO coupons, U.S. bank draft, or order through your book dealer.

TOC

## THE INDUSTRIAL CHEMIST

will never forget the pandemonium caused by a young assistant rinsing a bottle labeled "Ether" and finding out that it also contained a little drying sodium. Labels for experimental material that are going outside the company should in particular contain some sort of disclaimer clause, *i.e.*, "For laboratory use only," or "Caution: Toxicity not evaluated." Although I don't recommend the lawyer's all-purpose label:

**"DO NOT USE THIS  
PRODUCT. IT MIGHT  
BE DELETERIOUS"**

it is often wise to get legal advice.

Finally, we get to the area of packaging and labeling for shipment. More than once I have encountered considerable delay because a material was not packaged in accordance with the regulations of the carrier. It is, therefore, wise to contact the carrier in advance, particularly if it is to be an airline, and get the regulations. Although a jet aircraft carries hundreds of gallons of kerosine, airlines are even fussy about the containers used to ship kerosine or other hydrocarbons. But their fussiness is well founded. Consider the case of the manufacturer of anhydrous HF from one of the underdeveloped countries who was eager to sell his plant to an American concern. The American concern asked for a typical product sample which was, in due course, delivered by the company president when he arrived in this country. The sample was packaged in a small wooden box, which the analytical laboratory was sure contained the HF in a steel cylinder. (Anhydrous HF has an atmospheric boiling point of 68°F, and this was in the summertime.) Imagine our surprise when, under the vermiculite, we found a polyethylene bottle. This bottle had been carried under the seat of an international airplane whose cabin pressure was well below atmospheric.

Fortunately for the passengers on this plane, the plant was producing a rather wet HF.

Frequently, trouble is encountered because the name for a material is not familiar to the carrier. We anticipated just this kind of problem when one of our people had to bring back from overseas some sample bombs containing hydrogen. Had we mentioned hydrogen and bomb in the same sentence at Customs, I am sure we would have been in trouble. In this case, "gas container" proved adequately descriptive and quite acceptable.

Finally, there are a couple of miscellaneous items that warrant attention. Years ago it used to be common practice to dip the cap of a bottle in molten paraffin to seal it. Plastic electrician's tape does the same job more neatly. (Be thoughtful and double the free end so that the recipient can remove the tape and keep his fingernails.)

Sometimes, one wants to store material under inert gas. Although nitrogen is probably best, a worthwhile expedient that is always available is natural gas. And remember, although it has become popular to store solids in polyethylene bags to prevent contamination by the container (it is surprising how much alkali can be picked up from glass), one should bear in mind that polyethylene is quite pervious to oxygen.

I cannot close this column without relating a humorous incident caused by lack of familiarity with packaging. One of my premed organic students advised me that the acetyl chloride needed for his experiment had been used up. I told him that there was a fresh container in the hood and he disappeared for about a half hour. He had a look of consternation when he reappeared. He asked me to check his reaction because it did not look like anyone else's. It certainly didn't: it had 20 g of vermiculite floating serenely in it. The new acetyl chloride bottle was still evidently unopened in its can.

## CHEMICAL REACTIONS IN ELECTRICAL DISCHARGES

### ADVANCES IN CHEMISTRY SERIES NO. 80

Thirty-seven papers from a symposium sponsored by the Division of Fuel Chemistry and the Division of Physical Chemistry of the American Chemical Society, chaired by Bernard D. Blaustein.

A wide range of topics are covered in these papers by chemists, physicists, and engineers including treatments of decomposition and dissociation reactions, ion-molecule reactions, chemical syntheses, and chemical engineering aspects and physics of reactions in electrical discharges.

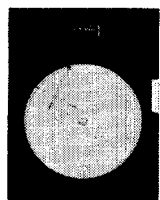
514 pages with index    Cloth bound    (1969)    \$15.00

Postpaid in U.S. and Canada; plus 30 cents elsewhere

Free set of L. C. cards with library orders upon request.

Order from: **SPECIAL ISSUES SALES**  
**AMERICAN CHEMICAL SOCIETY**  
1155 SIXTEENTH ST., N.W.  
WASHINGTON, D.C. 20036

## NORCROSS® Viscometers



Electrical Supply    To Measuring Element

### RECEIVERS

Indicating or Recording  
Electric or Pneumatic Control  
High and Low Alarms  
Electric Output for Data Processing

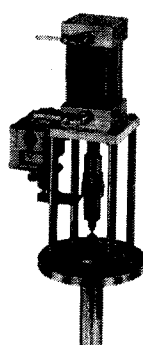
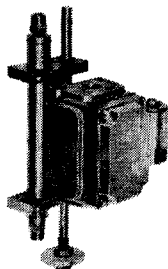
### MEASURING ELEMENTS for

Open  
tanks

Pressure  
Vessels

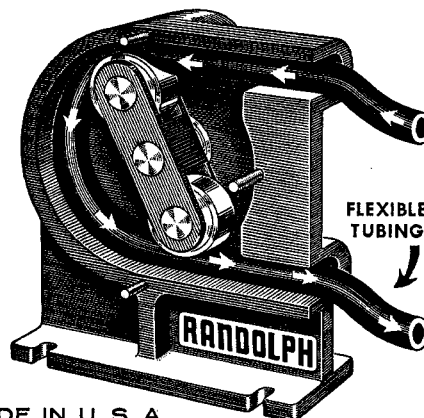
Side  
Streams

In Line  
Applications



Write Dept. A-84, or phone (617) 969-7020  
**NORCROSS CORPORATION**, Newton, Mass. 02158  
Representatives in Principal Cities and Foreign Countries

## The Pump That Never Gets Wet



MADE IN U. S. A.

## RANDOLPH PUMP

FLUIDS FLOW THROUGH A FLEXIBLE  
TUBE WITHOUT CONTACTING THE PUMP  
CAPACITIES UP TO 200 GALLONS PER HOUR

FOR FREE CATALOG CONTACT THE RANDOLPH CO  
1054-A ROSINE ST.    HOUSTON, TEXAS 77019  
Phone (713) 526-2091 Extension 506

## SPRAY NOZZLE IDEAS from SPRAYING SYSTEMS CO.



### DeflectoJet® NOZZLES

Projects extremely wide hollow cone spray  
in choice of 120°, 150° and 180° spray  
angles. Capacities from 1.2 to 15.8 GPM  
at 100 psi. Write for Bulletin 146.



### Jet-Stabilizer ADAPTERS

To eliminate effects of turbulence in  
close-coupled manifold, tee and elbow  
nozzle mountings. Steadies spray pattern,  
increases impact of flat spray nozzles.  
1/8" to 1 1/4" NPT sizes. See Bulletin 148.



### WALL MOUNTED FullJet® NOZZLES

Permits wall mounting where nozzle sprays  
in enclosed vessel or tank. Full cone spray  
in choice of capacities from 0.30 to 349  
GPM at 100 psi. Write for Catalog 25A.



### TO AIR ATOMIZE HIGH VISCOSITY FLUIDS

Mixes air and liquid externally  
... for spraying higher  
viscosity fluids or abrasive  
suspensions. Choice of  
capacities from 0.8 to 72.0  
GPH. Write for Bulletin 153.



### SPRAYING SYSTEMS CO.

3255 Randolph Street, Bellwood, Illinois 60104

FOR GENERAL NOZZLE INFORMATION WRITE FOR CATALOG 25A



## DIVISION OF INDUSTRIAL AND ENGINEERING CHEMISTRY

### CHEMICAL TECHNOLOGY—GOALS AND PHILOSOPHY FOR NEW ACS MAGAZINE



CHAIRMAN  
ROBERT N. MADDOX  
School of Chem. Engrg.  
Oklahoma State  
University  
Stillwater, Okla. 74075  
405-FR2-6211, Ext. 7565



CHAIRMAN-ELECT  
JAMES D. IDOL, JR.  
Standard Oil Co. (Ohio)  
4440 Warrensville Ctr. Rd.  
Cleveland, Ohio 44128  
216-575-6318

SECRETARY  
JAMES R. COUPER  
Dept. of Chem. Engrg.  
University of Arkansas  
Fayetteville, Ark. 72701  
501-575-4951

PROGRAM SECRETARY  
VERNON A. FAUVER  
834 Building  
The Dow Chemical Co.  
Midland, Mich. 48640  
517-636-0160

TREASURER  
NORBERT PLATZER  
Monsanto Co.  
730 Worcester St.  
Indian Orchard, Mass.  
01051  
413-788-6911

COUNCILORS  
NORBERT PLATZER  
JOSEPH STEWART  
Esso Research & Engrg.  
Co.  
50 Rockefeller Plaza  
New York, N. Y. 10020  
212-974-2656

Of great interest to the members of the Division of Industrial and Engineering Chemistry is the American Chemical Society's recent announcement of a new magazine, *Chemical Technology*, which will begin publication in January 1971. Dr. Benjamin J. Luberoft, who has played an active role in Division affairs, has been named Editor.

The idea behind *Chemical Technology* came from recognition of several facts:

- Nearly 100,000 ACS members are in industrial practice
- Industry requires that problems be solved
- These problems are diverse in nature so the solutions require a diversity of knowledge
- Creative solutions even require the use of knowledge which is *apparently* totally unrelated to the problem

*Chemical Technology* has therefore been charged with imparting authoritative, interdisciplinary information of reasonably immediate relevance to those charged with industrial innovation, those planning such careers, and those charged with their training. It will endeavor to treat not only chemistry and engineering, but also those sister disciplines, understanding of which is so necessary to see an idea through to commercial fruition. The Advisory Panel of the magazine reflects this breadth since each member will be an appointee of one of the 12 ACS Divisions most concerned with industrial problems. At its first meeting, this Panel selected the representative of the I&EC Division as permanent chairman. Dr. Leo Friend holds this post.

*Chemical Technology* will be more a current awareness magazine than an archival journal. It will place heavy emphasis on readability, but at the same time will endeavor to be profound and detailed enough to lead to productivity. The new magazine will first appear in January 1971, and all ACS members will have an opportunity to see the first six issues without charge. Initial circulation is therefore expected to exceed that of any other ACS monthly.

Because this new magazine, in all elements of its conception, is so closely associated with the practices and needs of the Division of Industrial and Engineering Chemistry, it is anticipated that Division members will be interested in the prospect of submitting manuscripts of suitable quality in accordance with the foregoing discussion. Several manuscripts are already being processed, and contributions from Division members will be welcome. Your manuscript may be sent to:

Dr. B. J. Luberoft, Editor  
CHEMICAL TECHNOLOGY  
The Bassett Building  
Summit, N. J. 07901 (Telephone 201-273-4923)

### FIRST INTERNATIONAL SYMPOSIUM ON CHEMICAL REACTION ENGINEERING, JUNE 8-10, WASHINGTON, D. C., CARNEGIE INSTITUTION

We are printing again for your convenience a registration form for the 1st International Symposium on Chemical Reaction Engineering. The meeting is scheduled for Monday, Tuesday, and Wednesday, June 8, 9, and 10 at the Carnegie Institution, Washington, D. C. Details were published in the April issue of I&EC, pages 6 and 7. This is the program planned by the American Chemical Society, the American Institute of Chemical Engineers, and the European Federation of Chemical Engineers.

If you plan to attend the symposium, please use the preregistration form below. Return it as soon as possible to David E. Gushee, Registration Chairman, 1st ISCRE, American Chemical Society, 1155 16th St., N.W., Washington, D. C. 20036 (USA), Phone 202-737-3337. Please make checks payable to 1st ISCRE. You may also register at the symposium site.

#### 1ST INTERNATIONAL SYMPOSIUM ON CHEMICAL REACTION ENGINEERING Washington, D. C. June 8-10, 1970

- |   |          |
|---|----------|
| <input type="checkbox"/> Member of ACS, AIChE, EFChE..... | \$40.00* |
| <input type="checkbox"/> Nonmember of above.....          | \$50.00* |
| <input type="checkbox"/> Student.....                     | \$10.00  |

Name

Firm/Univ.

Mailing Address

City, State  Zip

Title  Amount enclosed \$

\*Includes bound copy of proceedings when available.

☐ Hold badge for arrival ☐ Send to mailing address

# REACTION ENGINEERING—THEORY AND PRACTICE. AIChE PROGRAM

Statler-Hilton Hotel, Washington, D. C., Saturday and Sunday, June 6-7, 1970

As a prelude to the First International Symposium on Chemical Reaction Engineering, sponsored jointly by the American Chemical Society, the American Institute of Chemical Engineers, and the European Federation of Chemical Engineers, June 8-10, Washington, D. C., the AIChE will present a special program on Reaction Engineering, also in Washington, June 6 and 7, at the Statler-Hilton Hotel. Limit: 60 persons.

All registrants will receive course notes approximately two weeks before the course is scheduled to be given. This is meant to afford attendees an opportunity to be conversant with the text prior to taking the course. We cannot stress too strongly the need for reading this material prior to attending the course.

Registration fee includes coffee breaks at 10:00 a.m. and 3:00 p.m. each day and lunch at 12:00 noon.

Fee for the two-day course is \$100 to members of AIChE, ACS-IEC, and the European Federation of Chemical Engineers; \$125 to nonmembers. Each registrant will make his own hotel reservation.

Discounts are available to organizations desiring to send six or more persons to the same program. In addition, organizations can arrange for the performance of AIChE continuing education programs within their own facilities. For full information, contact the AIChE Continuing Education Department.

Students may register at one half the member fee. Each of these applications must be accompanied by a letter from a faculty member indicating that the student is enrolled full time.

No cancellation will be accepted after 12:00 noon of one week prior to the scheduled date of the program. Registrants, however, may send substitutes by notifying AIChE National Headquarters. Applications will be accepted beyond this data, provided space is available. Refunds will be made once the attendance limit is reached. All telephone inquiries should be made to 212-PL2-6800, Ext. 400 or 401.

## LECTURERS

Lecturers for this AIChE Today Series are J. Carberry, Professor of Chemical Engineering, University of Notre Dame, South Bend, Ind., and Dr. V. W. Weekman, Jr., Supervisor of Systems Research, Mobil Research and Development Corp., Paulsboro, N. J.

## SCHEDULE

### Saturday, June 6

9:00 A.M.-5:00 P.M.

#### 1. Introduction

Description of basic chemical reactions. Experimental basis, theory and character of various reaction networks, fundamentals of conversion, and yield in autocatalytic and non-catalytic reactions.

#### 2. Extracting Rate Constants from Data

Analytical methods (Prater-Wei, nonlinear estimation methods, error analysis, problems of disguised kinetics)

#### 3. Ideal Limiting Reactor Behavior

Plug flow and stirred tank reactors both isothermal and adiabatic. Effect of reactor on conversion and yield.

#### 4. Homogeneous Reactor Design

Batch, semibatch, plug flow, and series of stirred tank examples

#### 5. Experimental Reactors

Differential *vs.* integral, isothermal *vs.* adiabatic, fixed, fluid, moving and transport reactors, steady state *vs.* unsteady state, problems and pitfalls

#### 6. Introduction to Heterogeneous Reactions

Types and general character of diffusion reac-

tion. Heat and mass transport in series and with reaction

#### 7. Gas-Liquid Reactions

Theories and utility of film theory. Design examples

### Sunday, June 7

9:00 A.M.-5:00 P.M.

#### 1. Gas-Solid Noncatalytic Reactions

Shell progressive mechanism theory, example of coke burning from porous catalyst particles

#### 2. Catalytic Two-Phase Flow Reactors

Regimes of flow, liquid holdup, heat transfer, trickle flow kinetics, industrial examples

#### 3. Principles of Heterogeneous Catalysis

Catalyst types, chemisorption equilibrium, kinetics

#### 4. Catalyst Decay and Reactor Performance

Causes of decay, charge poisons, product poisons, effects on conversion and yield, effect of diffusion

#### 5. Diffusion and Catalytic Reaction

Key parameters and effects. Models of real systems (*e.g.*, sulfur dioxide, ammonia)

#### 6. Catalytic Cracking Examples

Effect of various reactor configurations, catalyst decay, selectivity behavior, hazards of catalyst evaluations

## PREREGISTRATION FORM—SEND BY JUNE 1, 1970

To: AIChE, Continuing Education Department, 345 East 47th St., New York, N. Y. 10017

Name \_\_\_\_\_ Co. \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_

State \_\_\_\_\_ Zip Code \_\_\_\_\_ Business Phone No. \_\_\_\_\_

AIChE Member: Yes ☐ No ☐ ACS Member Yes ☐ No ☐

EFCHE Member: Yes ☐ No ☐

Please Invoice ☐ Payment Enclosed ☐

Fee: \$100 Members; \$125 Nonmembers

Enclose a check for the appropriate amount payable to AIChE and mail to the address shown at the top of this form


For Office Use Only