

# LIGHTNIN EXTRACTION news

A Newsletter for Solvent Extraction Engineers

October 1996, Vol. 2, No. 3

## LIGHTNIN R-320 Pumper Impellers Achieve Impressive Entrainment Results

LIGHTNIN has announced that its R-320 pumper impellers have consistently achieved 6-10 parts per million entrained organic in aqueous solution in worldwide copper solvent extraction applications.

Traditional entrainment losses are in the 40-50 ppm range. Best alternate designs yield 25 to 30 ppm, according to LIGHTNIN Market Development Engineer Michael Giralico.

After one year of operation, copper solvent extraction sites operated by Cerro Colorado, Santa Barbara, Manto Verde,

and Codelco Salvador all reduced entrainment losses to 6-10 ppm.

Giralico says the reduction in entrainment losses can be attributed to the consistent, optimum droplet size produced by the R-320 family of pumper impellers, working with A310/A6000 auxiliary impellers. This system was introduced in late 1994.

"By studying more than 200 pumper designs and configurations, LIGHTNIN has proved a distinct link between

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## Patented, Two-Impeller System Increasing SX/EW Productivity

A new, two-impeller system from LIGHTNIN is helping customers optimize the complete range of solvent extraction/electrowinning processes. The new system has already produced extremely successful results in full and pilot scale plants in the United States and South America.

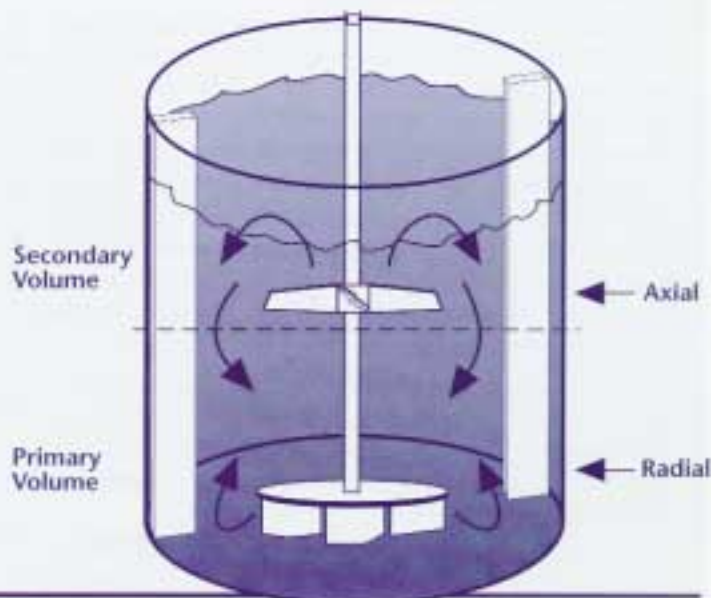
The patented design combines the LIGHTNIN R320 family of pumper impellers and A310 or A6000 axial flow impeller. The lower pumper and upper axial impellers are the most energy-efficient impellers available in the market.

Here's how it works: Imagine that the tank is divided into two volumes. In the bottom of the tank, an R-320 pumper impeller provides flow and head requirements. In the larger, upper volume, an axial flow A310 or A6000 impeller ensures proper mixing to provide the flow and contacting necessary for a continuous dispersion, guaranteeing the mass transfer stage efficiency.

Simply, each impeller is doing the job it was designed for. The pumper only pumps and the secondary impellers mix. The impeller system has no excess shear to create fines that are attributed to entrainment losses. These impellers were custom designed to eliminate shear using our Laser Doppler Velocimeter laboratory.

The design is expected to revolutionize pilot plants,

small-scale copper plants, other minerals solvent extraction applications, and single-tank mixing systems. LIGHTNIN can now offer single- or two-impeller design and handle the complete range of system requirements. Contact your regional sales representative to determine which LIGHTNIN system can maximize your profits.



## Practically Speaking:

# A Dollars and Cents Look at LIGHTNIN's System

By Mike Giralico

The actual entrainment numbers are in and we are happy to report that the results are even better than what we initially anticipated. This is the operational proof showing that it is possible to achieve the industry's lowest reported entrainment levels using a conventional system with LIGHTNIN's optimized impellers and system design capabilities.

During last year in Latin America alone, there have been at least eight new installations, expansions, or retrofit startups of LIGHTNIN impeller systems in conventional systems. The new installations and expansions can take full advantage of our expertise by not only using our energy-efficient impellers, but by working together as a team to design the complete mixing system, including tank dimensions, retention times, and pipe sizes. Retrofits use high-technology impellers (R320 family pumps and A310 or A6000 auxiliaries) to immediately reap the benefits of daily operational chemical savings, resulting from the low entrainment levels.

Typical entrainment levels reported in these referenced plants fall within a range of 4 ppm organic in aqueous being the lowest to 20 ppm being the highest. The average level was 8 to 15 ppm. These low numbers are being sampled in the launder overflow and are processed with the Horiba method. Entrainment levels in the electrolyte going to EW range between 1 to 5 ppm after filtering. These numbers are reported by the actual

operators during our routine followup. They are by far the lowest reported in the industry and even exceeded our high expectations.

Let me show you what this can actually mean to your operation using the following example of a typical retrofit. This example will compare a plant that has entrainment levels of 120 ppm that will reduce the entrainment levels to 20 ppm by using high-technology, energy-efficient impellers. The plant is designed for 2,500 cubic meters/hour against a head of 800mm.

Operating cost of solvent = \$11.00 (US)/kg

Typical solvent replenishment cost for a plant with 120 ppm entrainment at average plant production of 120 tonnes/day is six liters of solvent/ton copper. The same chemical cost for a plant running at 20 ppm is one liter of solvent/ton copper.

Operational costs associated with organic entrainment losses in the 120 ppm plant is \$8,000 (US) per day or \$3 million per year. This can be compared to \$1,320 per day or \$500,000 per year for a plant at the 20 ppm level. The retrofit will save you \$2.5 million per year in solvents. These savings cannot be ignored! Imagine how great the savings would be with entrainment values of 5 to 15 ppm.

This is profit your plant could be making now. Talk to your LIGHTNIN representative about how you can optimize your system or retrofit your existing plant. Take the steps necessary to install the latest technology to produce maximum operating income.

## LIGHTNIN Entrainment Data

From page 1

efficiency, droplet size, and entrainment losses, which are the second-highest cost of a solvent extraction plant operation," Giralico says.

Per volume, small droplets have larger surface areas than large droplets. This is important for mass transfer; however, excessive shear and turbulence can make these droplets too small, which causes aqueous components to be trapped in the organic phase, and organic components to be trapped in the aqueous phase. Organic traces in the electrolyte impairs the quality of the electro-deposited copper; organic traces in the raffinate are sent back to the heap and are lost to the environment. In either case, these losses must be recovered or replenished, at great operational expense.

Droplets that are too big are not as efficient because the surface area-to-volume ratio decreases with the increasing droplet size and therefore causes incomplete mass transfer. (Large droplets do not affect mass transfer, but aid coalescence.)

In addition to improved head and flow characteristics, the R320 family of impellers produce the least shear and turbulence at a given tip speed of any commercially available pumper impeller.

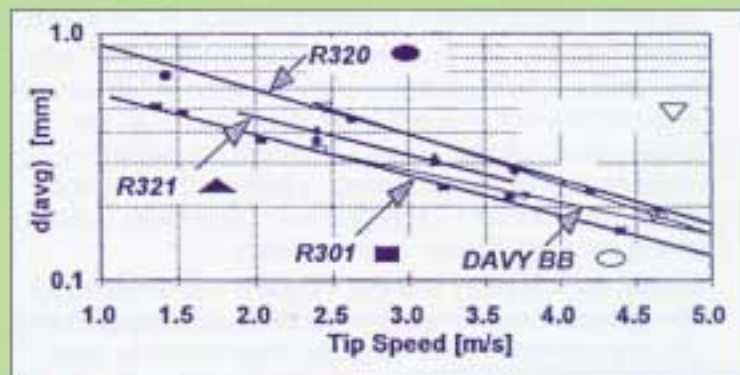


Fig. 1: Effect of tip speed on the mean (average) droplet size of five pumper designs. In this comparison, only the R301 had straight blades. There is a significant spread in mean droplet sizes based on pumper design.

# Phosphate Fertilizer Production Benefits From LIGHTNIN Technology

(This is the second in a series of articles which provides a brief overview of LIGHTNIN's technology and research in other major mineral recovery programs.)

Each year Northern and Central Florida produce about 40 million metric tons of phosphate rock of average  $P_2O_5$  content of 31-34 percent. This accounts for 80 percent of the United States and 30 percent of the world supply of phosphate rock that is processed primarily for fertilizer. This makes Florida the largest producer of phosphate fertilizer in the U.S.

Phosphorous is found most abundantly in the deposits of the phosphate rock in the form of the mineral Apatite. The mineral actually has four major forms. The Florida Apatite is found in a matrix that contains about 1/3 phosphate minerals, 1/3 sand, and 1/3 clay.

There are three basic steps to produce phosphate fertilizer:

- Concentrate phosphate ore to obtain a desirable grade of phosphate rock.
- Convert the ore to phosphoric acid by reacting rock with sulfuric acid (see below),
- Ammoniate, granulate, and blend to produce granular fertilizer of various types.

The most common method for producing phosphoric acid from rock is the Dihydrate Reaction, in which the ore reacts with sulfuric acid, which produces phosphoric acid and the

by-product calcium sulfate. The ground up rock slurry is mixed with sulfuric acid in either a series of "attack tanks," or in a larger volume reactor with a draft tube mixer. A mixer must not only suspend phosphorous rock and blend acids, it must also create sufficient velocity to discourage gypsum, a by-product, from building up on tank walls.



A320 Impeller

Traditional attack tank impellers were A200s, however, recent developments have demonstrated that the A320 provides superior blending and gas handling which results in greater yield recoveries. Currently there are two installations in the U.S.

Draft tube reactors require the C100/C110 family of high flow-high pressure impellers. Current installations for this service include every commercial plant in operation.

During the 1990's, development of the highly efficient A310 and A320 impellers provides the opportunity for LIGHTNIN to retrofit aging competitive installations and to correct process problems of foaming and excessive calcium sulfate losses.

Major growth in the phosphoric acid market will come from outside the United States. Current expansion is most noticeable in developing nations that must seek ways to build their capacity to produce phos acid internally to lessen the costly burden of dependency on foreign imports.

Benefits of the R320 impeller have been confirmed using Laser Doppler Velocimetry (LDV) and through multiple domestic and international installations at flow rates exceeding 15,000 GPM.

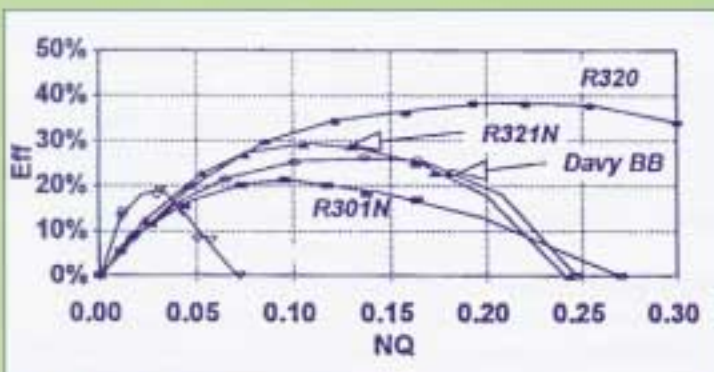
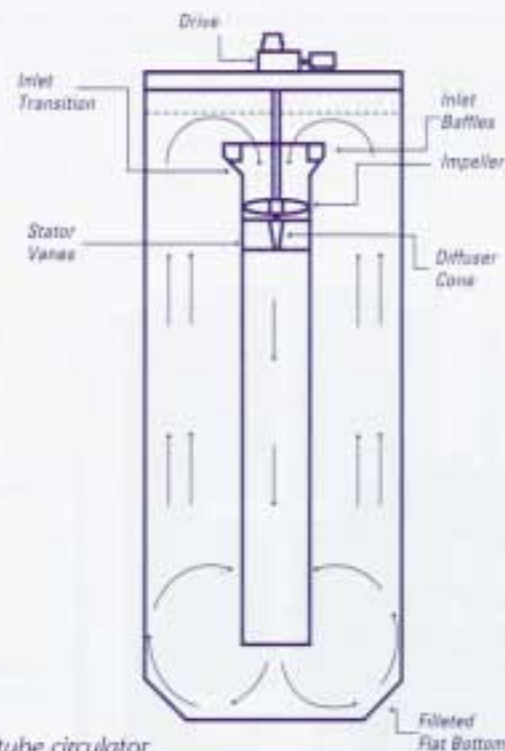


Fig. 2: Hydraulic efficiency as a function of Nq for five pumpier designs. The points represent a tip speed of 3.8 meters per second.



Draft tube circulator

# Solvent Extraction News Roundup

## Spectacular Showing at Expomin

LIGHTNIN presented a spectacular show at Expomin '96, the world's second largest mining exhibition, generating leads from Venezuela, Ecuador, Bolivia, Peru, Brazil, Argentina, and Chile.

LIGHTNIN Solvent Extraction team member Mike Giralico presented the paper, "Proceso de extraccion por solvente para cobre. Optimizacion del diseno y la operacion de las turbinas de bombeo y auxiliares," as part of Expomin's technical/commercial meetings.

## Minerals Roundtable

Nearly 50 LIGHTNIN application engineers and sales representatives from around the world gathered in Rochester June 11-13 for a technical summit to discuss and evaluate mixing technology in the Minerals Extraction Industries.

Discussions and presentations covered current mining and processing practices, future trends, and selecting

optimal mixing procedures and equipment in iron, copper, soda ash, alumina, gold, nickel and phosphoric acid. The meeting looked at draft tube applications and solvent extraction, as well as issues of mechanical design. R&D also discussed relevant findings in mixing technology, and an afternoon was also devoted to laboratory demonstrations.

Each topic was chaired by an expert within that particular field and supported by a panel of sales representatives and application engineers, who exchanged ideas and mixing techniques with the audience.

The meeting was sponsored by the Global Market Strategy and Technology Group at LIGHTNIN. The group was formed earlier this year with the intent of making LIGHTNIN more customer focused and developing marketing and technical strategies that more closely addressed customer needs. Another Roundtable is planned for October.

Visit LIGHTNIN on the Internet: [www.LIGHTNIN-MIXERS.com](http://www.LIGHTNIN-MIXERS.com)

# LIGHTNIN

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Printed in U.S.A.

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