

# LIGHTNIN EXTRACTION *news*

A Newsletter for Solvent Extraction Engineers

February 1995, Vol. 1, No. 1

## New Impeller To Redefine Solvent Extraction Technology

Not since the 1960s has copper solvent extraction benefitted from such a dramatic improvement in processing technology. LIGHTNIN has redefined copper solvent extraction methods by improving the best of current technology and sparing the need for costly capital improvements.

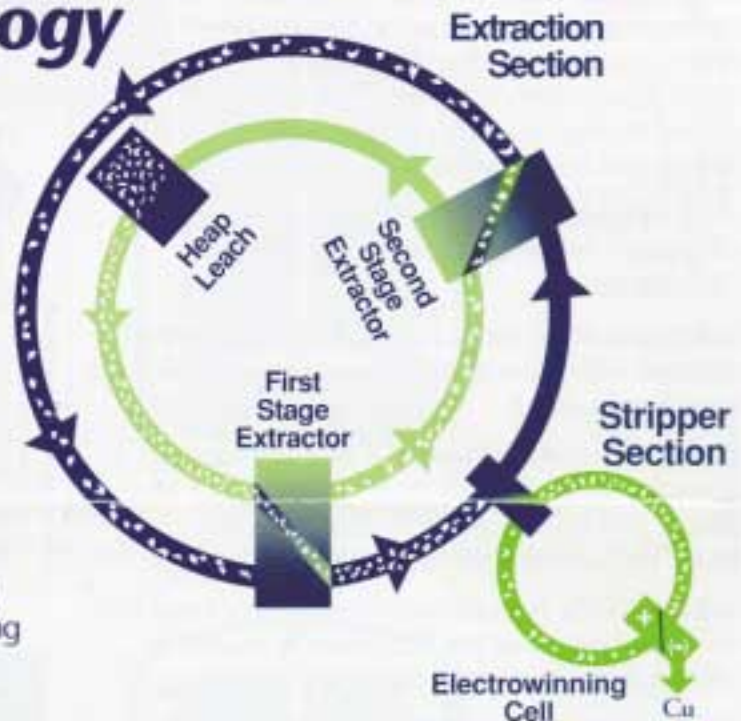
Solvent extraction technology has undergone continuous refinements over the years. However, trends toward larger plants and higher production rates have outpaced current processing techniques, which generate excessive shear and air entrainment at the higher power levels needed to meet production targets.

Instead of creating a costly new system, LIGHTNIN has substantially increased productivity by improving the primary pumper impeller design while maintaining the traditional system configuration.

The new R320 family of pumper impellers has the highest head and flow designated per power input yet developed and maintains the required mass transfer and copper recovery of traditional impeller designs. The R320 impellers are designed to:

- Maximize head and flow while reducing entrainment through lower power consumption
- Lower shear generation and turbulence
- Eliminate air incorporation
- Produce optimum droplet distribution
- Lower tip speed
- Greatly decrease operational expenses

These advances will allow design engineers and end-users to move from traditionally limited designs inward cost-effective, high-technology solutions for increasing the production rate of today's plant and tomorrow's larger mining operations.



### LIGHTNIN To Announce Study Results at SME

Research that led to the development of the new R320 pumper impeller will be presented at the Society for Mining, Metallurgy and Exploration conference and exhibit, March 6-8, 1995.

The R320 impeller can increase yields and greatly lower organic entrainment levels in copper solvent extraction. Details will be presented in a technical paper, "Improve the Performance of Your Copper Solvent Extraction Process by Optimizing the Design and Operation of Your Pumper and Auxiliary Impellers."

The paper will be presented by Thomas A. Post, Michael Preston, Michael Giralico and Richard Howk. LIGHTNIN will be at Booth 1067.

# 10 Reasons to Use the R320

Here are 10 reasons why the new LIGHTNIN R320 curved-blade pumper impellers can improve your solvent extraction process:

- **Lower capital cost** – Increased hydraulic efficiency means higher performance with smaller impeller diameters and lower torque. Result: reduced gearbox size, less installed horsepower, and lower wetted material cost (especially in high alloy).
- **Lower operating cost.** Reduced installed horsepower for lower energy costs and easier maintenance.
- **Elimination of air induction.** Required dispersion is produced without entraining air, which is caused by excess energy input.
- **Less loss from entrainment.** Organic losses are minimized by higher-efficiency, lower-power flow patterns and minimum shear characteristics. *Benefit:* big savings from using less chemicals.
- **Plant flexibility.** Handle wide variations of head and flow requirements as the PLS grade fluctuates to maintain a steady copper cathode production rate.
- **Existing plant upgradability.** One of the R320 impellers can replace your current pumper impeller. No other system changes are required.
- **Composite materials.** For seawater leaching and other high-chloride applications, Derakane® vinyl ester composite materials are available to replace higher alloy materials such as titanium.
- **Proven auxiliary design.** The A310 and A6000 axial flow impellers are proven in many installations to maintain uniform dispersions created by the R320, provide gentle mixing, and enhance phase disengagement in the settler at the lowest power available.
- **Confidence in design.** Proven performance from 6-inch lab scale to 106-inch full-scale with head, flow and power predictable to  $\pm 3$  percent.
- **We guarantee it.** As always, the LIGHTNIN guarantee (including developed head and flow) assures that your process will be met.



## Tests Confirm Research

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.

Extensive pilot work has led to the successful operation of a full-scale unit in a U.S. copper solvent extraction plant operating at 15,000 GPM total flow. In addition to improved head and flow characteristics, the R320 produced the least shear and turbulence at a given tip speed of any commercially available impeller. This feature reduces plant operation costs by minimizing organic entrainment losses and has been confirmed by droplet studies in the laboratory as well as full-scale scientific study results.

# Mixing Technology: Mixing Basics

Most consumer and industrial products obtained from chemical, food, petroleum, mining, pharmaceutical, and pulp and paper industries would be unavailable if not for fluid mixing technology.

Mixing process requirements vary and include (but are not limited to) blending low-viscosity fluids with high-viscosity fluids; suspending solids in liquids; dispersing gases or solids in liquids; mass transfer, and heat transfer. The specific type of mixing for a given process also varies from relatively low energy-intensive, simple fluid motion to high energy-intensive mixing that requires high levels of fluid shear and turbulence.

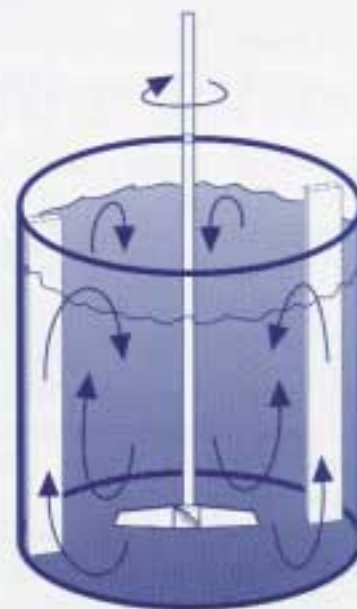
A fluid mixer usually consists of a drive mechanism and one or more impellers mounted on a shaft. Inside a vessel, the impeller rotates on the shaft to circulate materials to promote an interchange of materials within the system to satisfy the process requirement.

Mixers are available in a variety of types such as propellers, shrouded turbines, disk turbines, rakes, plates, paddles, pitched-blade turbines, but generally fall into two broad categories: axial and radial flow. (A third, less common category is tangential flow.)

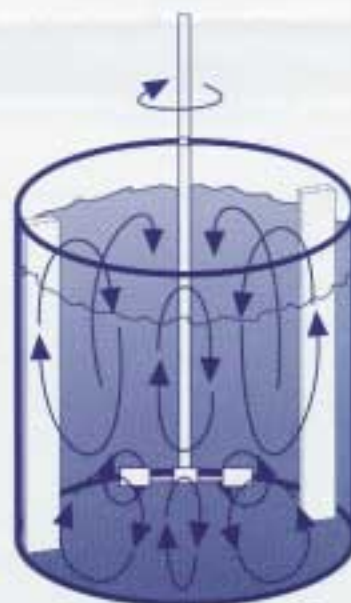
Axial flow impellers have a principal direction of discharge that coincides with the axis of impeller rotation. Radial flow impellers have a principal direction of discharge normal to the axis of rotation.

Power delivered by the mixing impeller can be analyzed as the result of flow times head. The agitation intensity in the immediate discharge zone of the impeller is defined by the fluid head, shear rate and turbulence. In fluid mixing technology, the terms "head" and "shear" and "turbulence" are used interchangeably. Either the flow component or the head component can be emphasized such that a large flow/small head or a large head/small flow can be produced for the same power input. The correct mixer design for a given application incorporates the proper balance of flow and head.

Axial flow impellers are used to circulate process components throughout the tank. Shear impellers impart a high level of shear into the batch that is used to disperse agglomerates and facilitate reactions.



*Typical Axial Flow Pattern*



*Typical Radial Flow Pattern*

Each mixing impeller has unique flow and power response characteristics. This information can be used to calculate the pumping capacity and power draw of a given impeller, but these quantities by themselves seldom are the sole basis for unit selection.

*Next issue: Characterizing flow*

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# ***LIGHTNIN Optimizes Your Impeller for Guaranteed Results***

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The yield, quality of product and smooth operation of your process all depend on mixing, so the starting point is critical.

Working together, you and LIGHTNIN determine what mixing must do to optimize the process. Then we guarantee the results.

LIGHTNIN has operated the world's largest mixing labs in which we can test your actual materials to determine optimal flow, head, power and other factors. Our proprietary computer software predicts changes in performance if the process requirements suggest modifying a standard design.

Once we recommend an impeller, you can study its operation in a mixing vessel at LIGHTNIN during a variety of lab-scale tests. Simultaneously, you see all of the relevant parameters measured. All of this is recorded on video tape for immediate and future analysis.

We have an 80-foot diameter tank, a 50-foot square tank, autoclaves and other equipment to evaluate mixing from benchtop to pilot, and if necessary, to full scale. When appropriate, we can even come in and test at your plant.

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For additional product or application information, call your local LIGHTNIN sales engineer, located in principal cities around the world. In the United States, call toll free, **1-800-320-3526, ext. 633**, for the name and phone number of the LIGHTNIN representative in your area.

Questions or comments for the LIGHTNIN Extraction News should be forwarded to:  
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