# <u>Recovery of Lactic Acid from Pickle Process</u> <u>Wastewater</u>

Bob Peart, Jennifer Couch, Brian Stamper

April 22nd, 2004

## **Objective:**

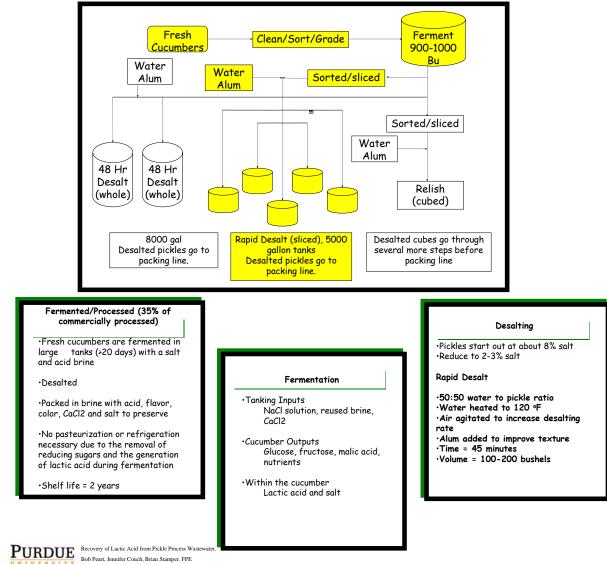
To determine if lactic acid can be removed from pickle process water in order to lower Biological Oxygen Demand (BOD) of wastewater.

# Purpose:

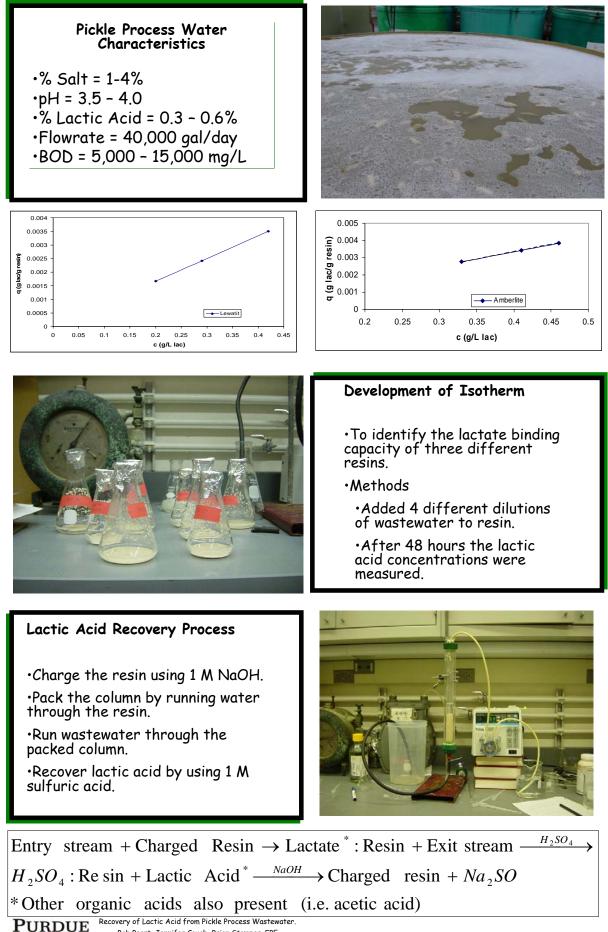
•Reduce BOD going to the public wastewater treatment facility and its associated cost.

•Reduce or eliminate the use of caustic to adjust pH of the process wastewater.

•To take a step toward eco-efficiency by increasing resource productivity.



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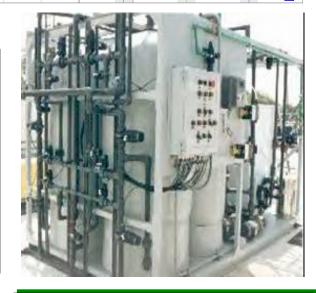


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ID	0	Task Name	Duration	Start	Finish	4, '0- T '		FS		, '04 T   W	TF	S		r 18, M 1		TF		Apr: S N					
1	-	Skid Mounted Ion Exchange and Deionization System	14 days	Mon 04/12/0	Thu 04/29/0		_			-							-		÷				
2		First Column is Lead Column	7 days	Mon 04/12/0	Tue 04/20/0								_		$\sim$								
3		Process wastewater enters pH buffer tank	1 day	Mon 04/12/	Mon 04/12/					L													
4		pH adjusted process water enters first column	1 day	Tue 04/13/	Tue 04/13/					h													
5		Exit stream from column pumped to Recovery Module	1 day	Wed 04/14/	Wed 04/14/						L												
6		Regenerate First Column	4 days	Thu 04/15/0	Tue 04/20/0						<u> </u>	10000	-		$\sim$								
7		Resin becomes saturated	1 day	Thu 04/15/	Thu 04/15/					- 1	n.			Γ									
8		pH adjusted process water recirculated back to buffer tank	1 day	Fri 04/16/	Fri 04/16/						Ľ	-	-	.									
9		Resin is regenerated and recharged	1 day	Mon 04/19/	Mon 04/19/								Ĩ										
10		Regenerant is pumped to recovery module	1 day	Tue 04/20/	Tue 04/20/									Ť									
11		Second Column becomes lead column	7 days	Wed 04/21/	Thu 04/29/0									4	$\sim$		-		-				
12	11	pH adjusted process water enters second column	1 day	Wed 04/21/	Wed 04/21/											L							
13		Exit stream from column pumped to Recovery Module	1 day	Thu 04/22/	Thu 04/22/										i	h							
14		Regenerate Second Column	4 days	Fri 04/23/0	Wed 04/28/											Ň.	-		-				
15		Resin becomes saturated	1 day	Fri 04/23/	Fri 04/23/												$\vdash$	1					
16		pH adjusted process water recirculated back to buffer tank	1 day	Mon 04/26/	Mon 04/26/													E	h				
17		Resin is regenerated and recharged	1 day	Tue 04/27/	Tue 04/27/														Ľ		b	h	h
18	1	Regenerant is pumped to recovery module	1 day	Wed 04/28/	Wed 04/28/																Ì	Ľ	È
19		First Column becomes Lead column and process is repeat	1 day	Thu 04/29/	Thu 04/29/																		

### Scale up

- •REMCO skid mounted ion exchange and deionization systems.
- •System allows for complete process control •Closely control pH (±0.2)
- •Can manually override any automated step if necessary
- Continuous water treatment system •While column is regenerating, process water is recirculated in a holding tank •After regeneration is complete (~3-4 hrs), system automatically restarts treatment



### **Alternatives**

#### Electrodialysis

- •Electrochemical separation process to
- separate ionic species
- •Uses charged membranes and an
- electrical potential difference
- •Consists of a series of alternating anion
- and cation exchange membranes
- •Membranes separate ions from the solution
- •This process has successfully been used to
- separate inorganic and organic acids (i.e. lactate)

### Crystallization

- •Add CaCO3 and Ethanol to process water.
- •Crystallize out Lactate and CaCl2
- Crystal size increases with increased concentration of lactic acid.
- ·Some temperature regulations are necessary.

#### Acknowledgements

Dan Burton of Dean Foods Dr. Martin Okos

Eli Lilly & Co.

PURDUE Recovery of Lactic Acid from Pickle Process Wastewater. Bob Peart, Jennifer Couch, Brian Stamper. FPE. April 22, 2004

#### **Entering Lactate Concentration** 0.179 Exiting Lactate Concentration 0.164 **Resorption Lactate** Concentration 0.252 Lactate adsorbed/g resin 0.00294g/g Synthesized Lactic Acid Solution Step % Lactate Entering Lactate Concentration 1.425 1.422 Exiting Lactate Concentration Resorption Lactate Concentration 1.598 Lactate adsorbed/g resin 0.00054 g/g \*\*Note: Error in analysis; lactate concentration too high for instrument\*\*

Pickle Process Wastewater

% Lactate

Step

## Future Goals & Initiative

•Concentrate the amount of lactic acid in the wastewater.

- •Reverse Osmosis
- Evaporation

Results

Ultrafiltration

•Examine alternative resins.