GELITA USA

SERGEANT BLUFF

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COMPANY PROFILE:

Gelita, founded in 1875, is a leading supplier of collagen peptides, collagen, and gelatin. Gelita is a German-based company with 22 production plants and 11 sales offices worldwide. A strong emphasis is put on cooperation among the various locations, represented by ONE GELITA, a vision based on future goals to reach the top position in the market. The plant located in Sioux City, Iowa, is the largest single site gelatin factory in the world with around 300 employees. The facility produces gelatin from pig skin and bovine bone, as well as collagen peptides from bovine hide.

PROJECT BACKGROUND

Production of gelatin and collagen peptides produces wastewater that contains nitrogen in the form of protein. At the Sioux City Gelita plant, any wastewater produced during operation is sent through a lagoon system. Treatment of this wastewater and removal of nitrogen is necessary prior to discharge into the Missouri River. The focus of the project was to assess product losses associated with a wastewater stream leaving the fats, proteins, and minerals building, and investigate alternatives for recovery or removal of the nitrogen in the stream prior to discharge into the lagoon system.

INCENTIVES TO CHANGE

Increasing production at the Gelita facility has led to an increase in load on the wastewater lagoon system. A new wastewater treatment plant, scheduled to be built by the end of 2025, will replace the current lagoon system to keep up with the increasing load. However, as a treatment plant, there will be no profit coming from it. Therefore, ways to minimize the load on the facility are being investigated. The stick water presents an attractive opportunity for protein recovery and wastewater treatment reduction.

RESULTS

Pig skin residue from the gelatin production plant is sent to the fats, proteins, and minerals building. It is then separated into different components, a grease, solid, and an aqueous phase (stick water). The grease phase is processed further and sold. The separated solids are sent through a dryer and used for meal production. The stick water is combined with other waste streams, and is eventually sent through the lagoon system for wastewater treatment. The stick water stream has collagen proteins in the form of gelatin that have the potential to be recovered and used in the meal production. Recovery of the protein would increase meal yields while also reducing the nitrogen content of the wastewater.

Stick Water Recovery in Meal Process

A baseline assessment was performed on the current meal production process and the stick water content to identify limiting factors for recovery. It was found that the current process contains two pieces of equipment that may limit recovery, a paddle dryer and glycol cooler. Further analysis was performed on the current conditions and design conditions of the two pieces of equipment and found that both the dryer and the cooler are operating below their maximum design conditions.

The stick water is made up of 3-3.5 percent proteins, fats, and ash, with the majority of the protein being collagen. From the analysis of the equipment and the stick water, it was concluded that the additional capacity would be sufficient for recovery of the entire stream. Recovery of the stick water protein should be done through rerouting the stream to the current meal dryer.

Gelatin present in the stick water is causing the high collagen content of the protein. Drying of this gelatin may cause it to partially solidify at lower moisture contents which can create a sticky substance prone to buildup. Burning of the built up material may occur, causing burnt pieces to be processed as meal affecting the digestibility. To avoid this possibility, breakdown of the gelatin in the stick water is necessary. Addition of an enzyme into the stick water will allow for separation of gelatin strands, forming low molecular weight collagen peptides. Size exclusion chromatography was used for analysis of the average molecular weight of the collagen peptide content. Tests at different concentrations were performed and compared to a control and a collagen peptide standard. It was concluded that the tested enzyme would be effective at breaking down the gelatin. To add enzyme into the current process two options are given. The first is the implementation of a shear pump upstream in the process to breakdown large solids and allow for enzyme addition into an existing holding silo. The second is the installation of two tanks to hold the stick water and added enzyme. Estimates for installation of piping, electrical, transfer pumps, and tanks were acquired.

Evaporator Addition*
A high moisture content in the stick water will have a major effect on the heating in the current dryer. Reduction of the heating requirements necessary to recover the stick water will minimize additional costs and steam usage. An old evaporator is being replaced in the pig skin gelatin production plant. Analysis of the evaporator conditions indicate that it is unable to completely dry the stream but can function as an initial concentration step to reduce steam usage. Relocation and installation of the evaporator is a large initial investment, which also comes with a significant increase in electricity usage due to the pumps and other devices. Estimates for the relocation and installation of the evaporator and associated piping, pumping, and electrical were acquired.

Recovery of the stick water proteins into the meal process will reduce the nitrogen load in the wastewater, while increasing the meal yield. To do this, it is recommended that enzyme is added into the stick water stream via a set of holding tanks in order to breakdown the gelatin and prevent issues within the dryer. Additionally, it is recommended that the evaporator being replaced in the pig skin gelatin plant is relocated into this process for higher efficiency drying and steam reduction.

ENVIRONMENTAL AND ECONOMIC SAVINGS TABLE

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
STICK WATER RECOVERY IN MEAL PROCESS	$125,400	39 tons TKN	RECOMMENDED
EVAPORATOR ADDITION*	$47,500	114,400 therms 561,100 gallons	RECOMMENDED

**Dependent on implementation of stick water recovery*