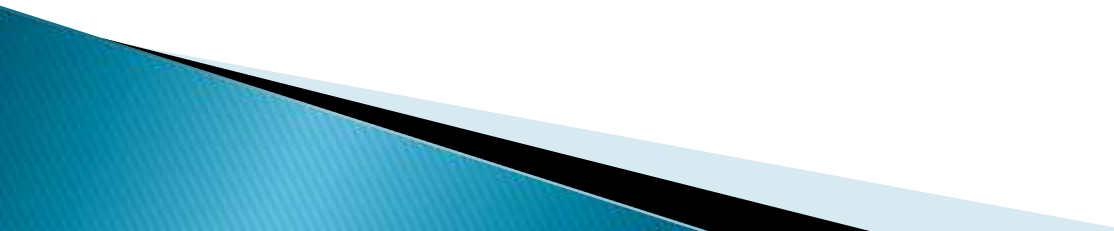


Dairy waste management

INTRODUCTION

- Pakistan is 5th largest milk producer in the world
 - About 4 % of the total production is processed into different products
 - Demand for milk and milk products have been increased all over the world as a result the no. of dairy industries have also been increased
 - Effluent per liter of milk 0.2 to 0.4L
 - So it is becoming difficult to manage the dairy effluents produced by these dairy industries.
- 

TYPES OF DAIRY EFFLUENTS

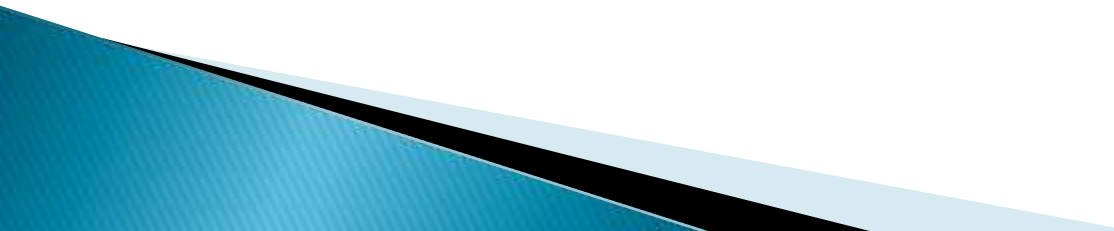
Effluent
water (CIP
water)

Whey (84–
90% of
total milk
in cheese)

Butter milk

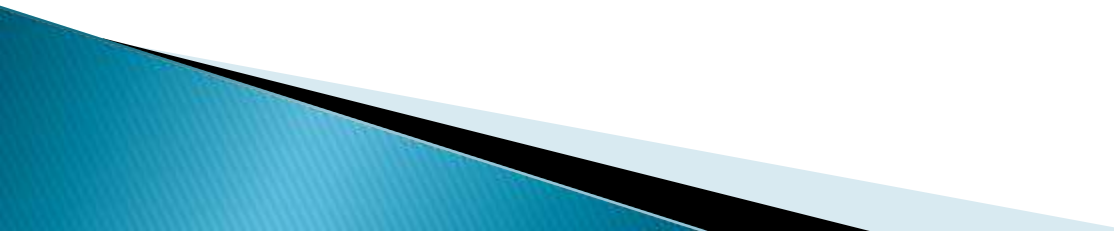
Wasted of
milk
during
processing
2%

Waste Water

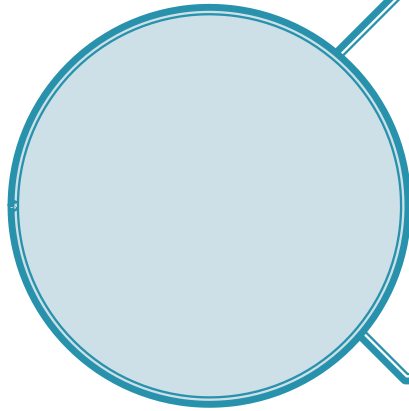
- Dairy industries are considered ‘wet industry’ as a result of use of huge volumes of water, which is employed for varied functions.
 - Dairy plant use lot of water throughout process for various purpose
 - As ingredient
 - For washing of equipments/CIP
- Dairy industry generates great deal of waste water classified by high
- Biological oxygen demand (BOD)
 - Chemical oxygen demand (COD)
- 

Waste Water Composition

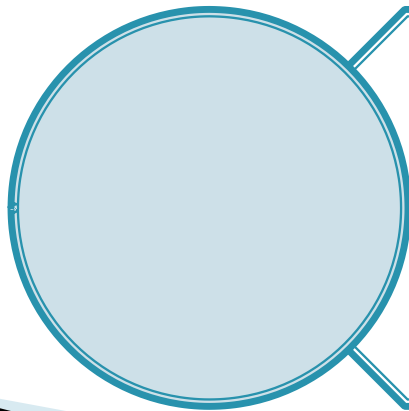
- Composition of wash water contain
 - High concentrations of water,
 - Product residues
 - Milk elements
 - Lactose

 - Primarily the dairy waste is
 - Organic
 - Slightly alkaline in nature
- 

Food Application of Waste Water



Production of
Single cell protein



Reuse of waste
water

Single Cell Protein

“Single-cell protein (SCP) defined as the formation of cell mass using microbes by culturing on available wastes”

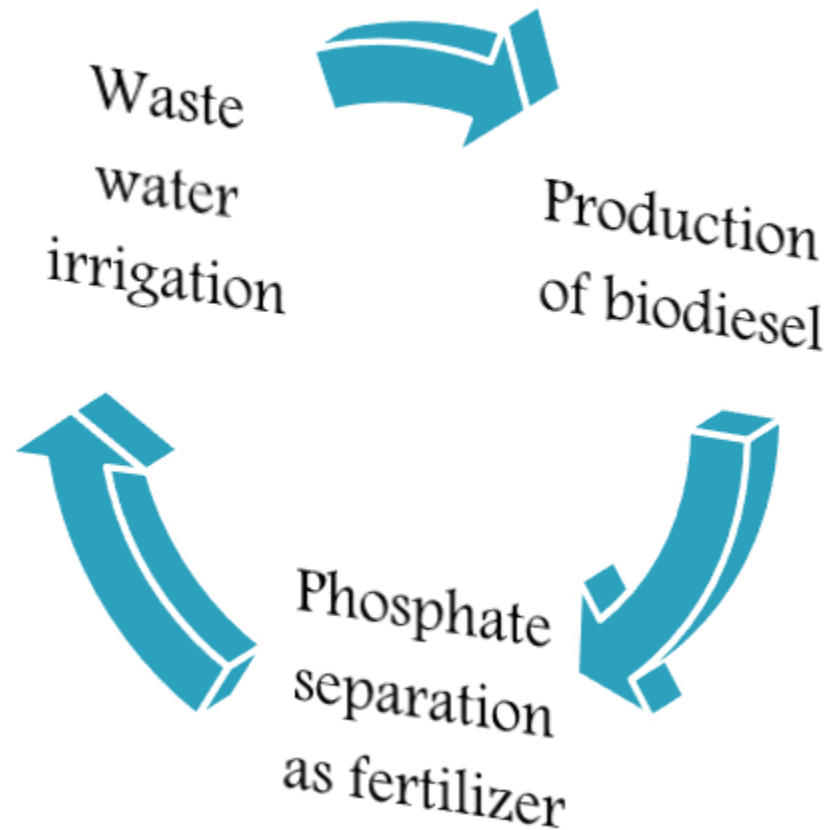
- Among all liquid industrial waste, dairy industrial effluent pose serious threat to our environment. There is a need to utilize them to form a single-cell protein (SCP)
- Due to high BOD and COD of lactose, dairy waste water is particularly suitable for the production of SCP using lactose-utilizing microorganisms
- These single cell protein (SCP) are used for rumen and poultry feed

Reuse of Waste Water

It is possible to reuse the dairy waste water for various food applications

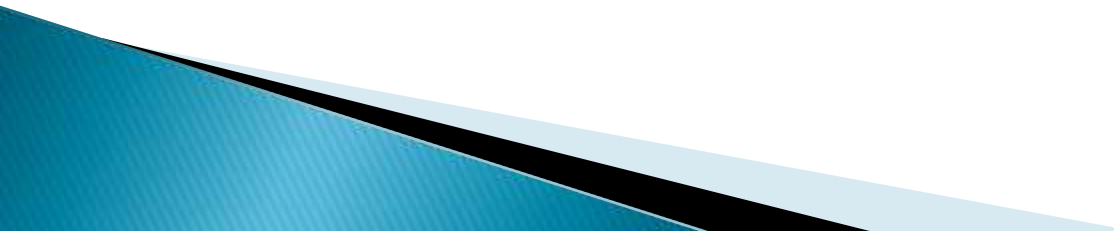
- Mechanical treatment
- Chemical treatment
- Biological treatment

Non Food Application

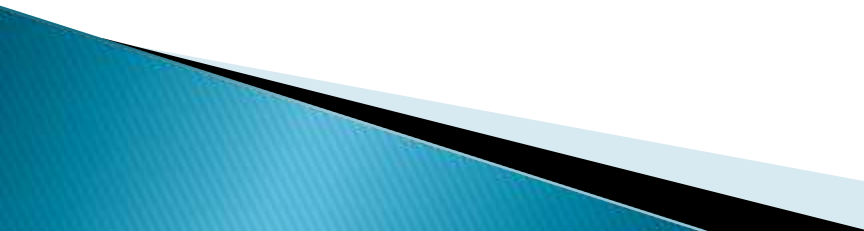


Cheese whey

- ▶ Whey from cheese considered as a byproduct of the cheese industry.
- ▶ Worldwide estimated production of whey is
- 115 million tons per annum.
- ▶ Almost 45–47% of the produced whey is disposed off into the environment

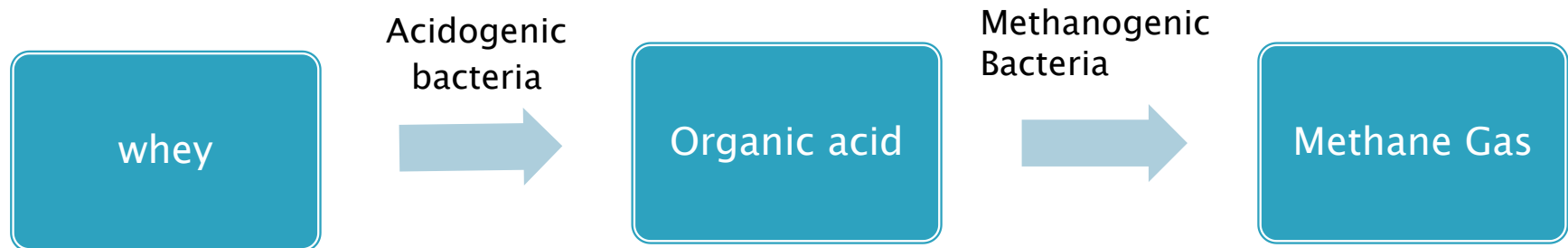
- ▶ Whey comprises of :
 - ▶ carbohydrates
 - ▶ lactic acid,
 - ▶ Lactose
 - ▶ fat and
 - ▶ proteins etc
- 

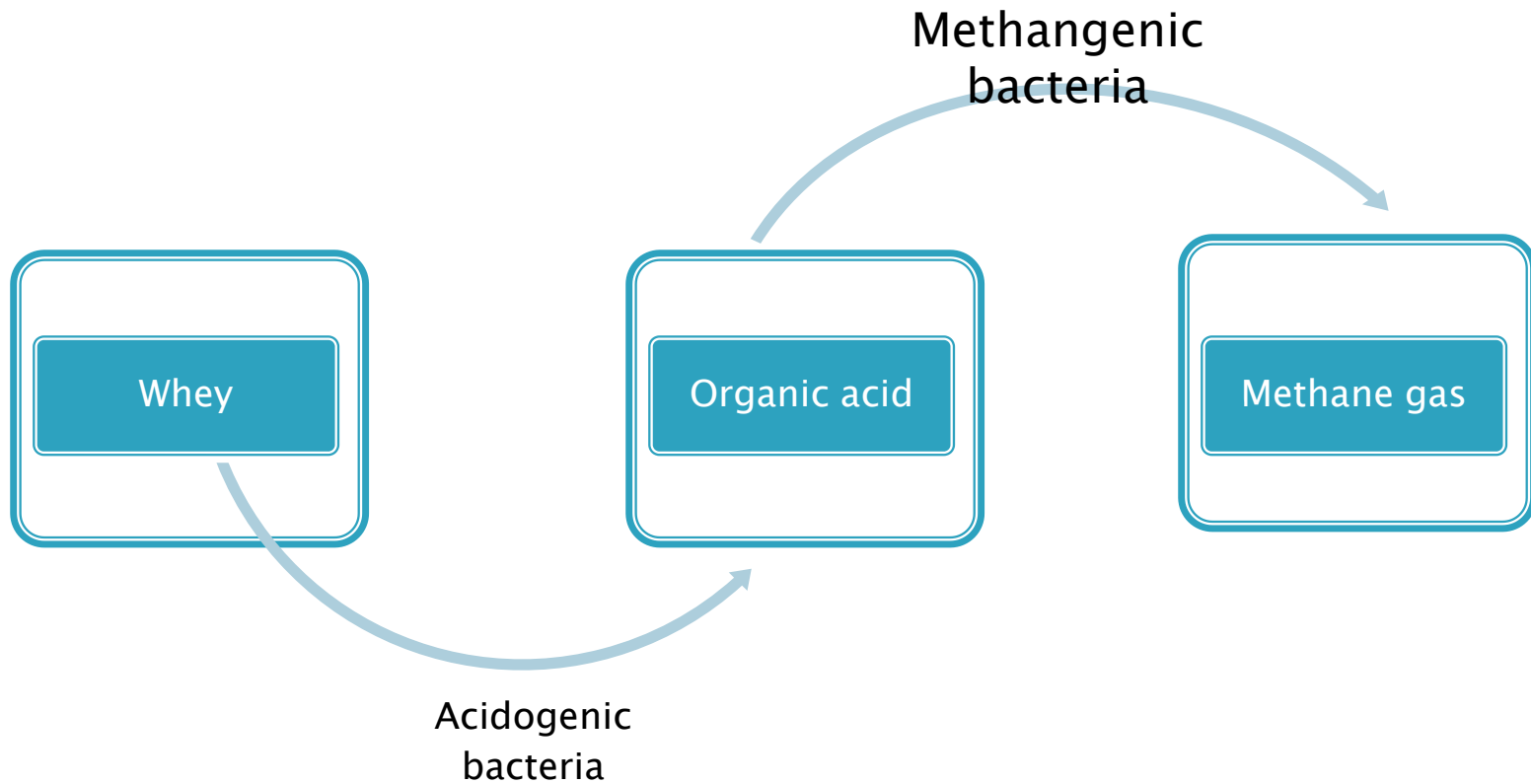
Methane production

- ▶ Anaerobic digestion is the most cost-effective technology for production of biogas from cheese whey
 - ▶ In the process of anaerobic digestion, initially acidogenic bacteria hydrolyzed whey and convert it into organic acids then further degradation of waste were carried out by methanogenic bacteria. As a result, methane gas produced which act as an energy source
- 

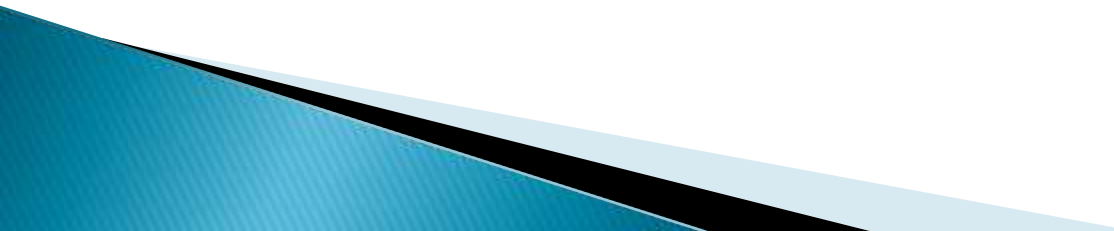
Methane production

- Production of bio gas by anaerobic digestion





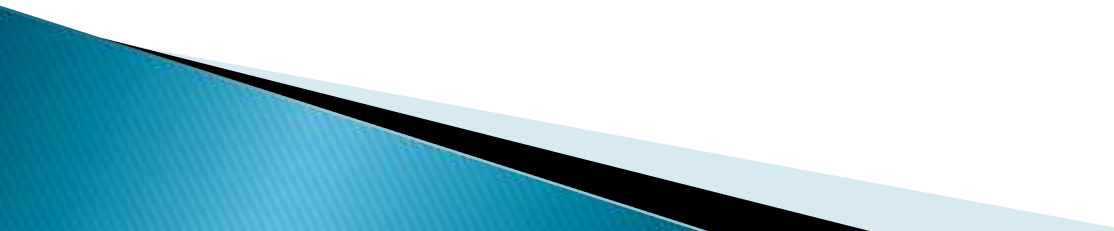
Food application

- ▶ Reuse of whey as animal feed
 - ▶ Cheese whey proteins
 - ▶ Fermentation to lactic acid
 - ▶ Lactose isolation
- 

Animal feed

- ▶ Powdered form of CW is easy to handle and transport and can be kept fresh for a longer period of time.
- ▶ So, CW powder is primarily used for animal feed and in smaller amounts can be used in foodstuffs designed for human consumption such as ice cream, bread, sweets, sauces, dairy products etc

- ▶ CW proteins, which comprise 15–22% milk protein
 - ▶ valuable to health and are characterized by a high nutritional value and
 - ▶ therapeutic potential

 - ▶ **Main proteins of whey**
 - ▶ α -lactalbumin,
 - ▶ β -lactoglobulin,
 - ▶ bovine serum albumin (BSA) and
 - ▶ bovine IgG
 - ▶ Minor proteins
 - ▶ lactoperoxidase,
 - ▶ lactoferrin
- 

- ▶ Separation of whey proteins
- ▶ ultrafiltration, or
- ▶ membrane processing,
- ▶ whey protein concentrates (WPC) or
- ▶ whey protein isolate (WPI)
- ▶ WPC contains 30%–90% proteins,
- ▶ WPI contains more than 90% protein on dry matter.
- ▶ WPC is free of salts, it is suitable for all types of human foods, even for dietary foods or baby.

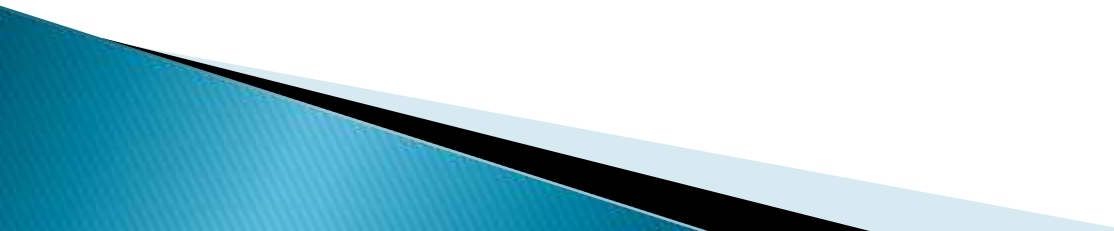
Lactose isolation

- ▶ 70% of milk whey consists of lactose.
- ▶ Compared to other sugars, the solubility and sweetness of lactose is low.
- ▶ Lactose is used mainly as a component of food,
 - ▶ infant formula and
 - ▶ as a filler or coating agent for tablets in the pharmaceutical industry.

Disadvantage:

- ▶ low digestibility and
- ▶ low solubility

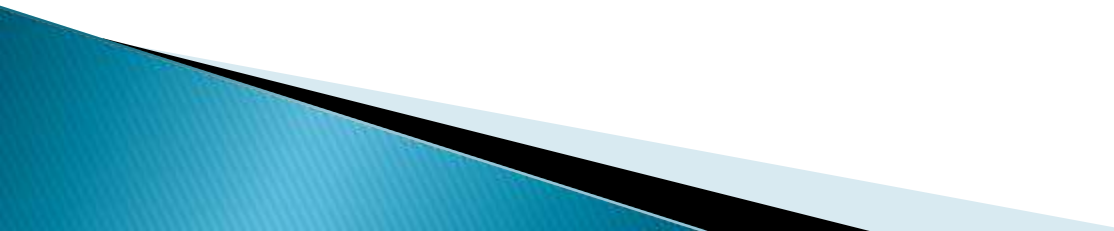
Non food applications

- ▶ Whey as a energy source
 - ▶ Fermentation of ethanol
 - ▶ Fermentation to hydrogen
- 

Fermentation to ethanol

- ▶ bioconversion of disaccharide to grain alcohol reveals a theoretical most worth of 0.538 metric weight unit of grain alcohol from one metric weight unit of lactose consumed

Buttermilk

- ▶ By product of butter industry
 - ▶ Churning of cream give equal amount of butter and buttermilk,
 - ▶ Butter milk powder used in many products due to higher functional properties
 - ▶ Butter milk added in many products like baking goods and in various dairy products
- 

Food applications

- ▶ **Butter milk by products**
- ▶ **Butter milk powder**

Buttermilk byproducts

- ▶ This byproduct contains:
 - 90% of the milk volume and
 - 56% of the milk nutrients.
- ▶ The most important of these nutrients are
 - lactose (40–50 g/L),
 - lipids (4–5 g/L),
 - soluble proteins (6–7 g/L), and
 - mineral salts (6%–8%)
- ▶ Mainly KCl and NaCl (more than 50%), calcium (mainly phosphate) and others.
- ▶ The buttermilk used in many products due to high amount of milk solids and also used as drink in summer season

Butter milk powder

- ▶ Due to a high content of phospholipids butter milk is used in many food products as a functional ingredient such as salad dressings, chocolate pasta, cheese seasonings, sauces, yogurt and ice cream mixes.
- ▶ Emulsification is the main functional property of butter milk

Waste minimization

Waste minimization is the

- ▶ Reduction in the generation of waste.
- ▶ Reuse of waste materials/by-products.