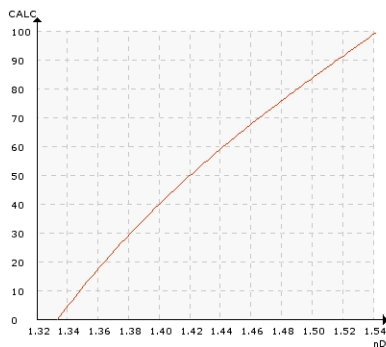


## WHEY PROTEIN AND LACTOSE

### Typical end products

Whey protein concentrate (WPC), whey powder, lactose, casein

### Chemical curve: R.I. per BRUX at Ref. Temp. of 20°C



### Introduction

Whey is a liquid residue of cheese and casein production, which contains large amounts of food protein. Whey comprises 80-90 % of the total volume of milk entering the process. It also contains about 50 % of the nutrients of the milk: protein, lactose, vitamins and minerals. Whey protein concentrate (WPC) is processed by ultrafiltration (UF). Also,

reverse osmosis (RO) or diafiltration are used. UF is the most widely used process of membrane filtration (fractionation) in the dairy industry. The principle of these processes is that a membrane restricts the passage of particles over a certain size. For example, in UF large particles like fats and proteins are retained (retentate), while small particles, like salts and sugars, pass through the membrane (permeate).

### Application

Whey must be processed as soon as it is collected to reduce bacterial activity. The process requires the following unit operations: fines and fat separation; ultrafiltration, where whey protein (retentate) and lactose (permeate) are separated; concentration by evaporation; spray drying for obtaining whey powder and bagging. Lactose goes through evaporation, crystallization, crystal separation, fluid bed drying and finally bagging.

Whey protein concentrate (WPC) is a powder, which contains 35-85% protein in dry matter. It is processed

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| <b>DAIRY</b>                   |                |
| <b>APPLICATION NOTE</b>        | <b>2.05.01</b> |
| <b>WHEY SEPARATION PROCESS</b> |                |

by concentrating and drying the whey retentate. To obtain more than 80% protein concentration, it is necessary to diafilter, add water to the UF feed to wash out low molecular components, to remove more lactose and to raise the protein concentration in relation to total dry matter.

Lactose is the main constituent of whey and there are two basic methods of lactose recovery. They are the crystallization of untreated but concentrated whey or the crystallization of whey, which the protein has been removed from by UF. After UF, the whey is first concentrated to 60-62 % dry matter via evaporation, and then it is transferred to crystallization tanks, where seed crystals are added to it. After crystallization, the crystals are separated by centrifuges and dried into powder in fluid bed driers. Before packing the lactose is also ground and sifted.

### Instrumentation and Installation


In both, the whey and lactose processing applications, the K-Patents Sanitary Refractometer PR-23-AC is used to control the correct feed product concentration for the following process step. Typically, the K-Patents' PR-23-AC sensor is installed on a pipe bend. It is angle mounted on the outer radius of the pipe bend directly or by using a flow cell. This way the best flow conditions and self-cleaning effect can be achieved.

The refractometer helps to control and adjust concentration levels after the ultrafiltration, and at the evaporator inlet. The concentration measurement from the evaporation process outlet assists in optimizing the evaporator energy consumption. It also ensures the correct feed product concentration to the spray dryer or crystallizer.

If an instrument is used in the RO process, it has to be mounted outside the loop, due to the high process pressure of about 40 bar.

Typically, prism wash is not required for any of these applications, since the plants are CIP cleaned every 10-20 hours. Typical process temperature for whey application is 10-70°C (50-158°F) and the measurements vary between 0 and 85 Brix.

The high accuracy control achieved with K-Patents precise in-line concentration measurements helps to improve end product quality and to reduce operating costs. Additionally the K-Patents PR-23-AC has a built-in web server that can be accessed via Ethernet, which significantly improves its ease-of-use. Obtaining real-time measurement data displays and diagnostics, altering instrument configuration settings or updating program versions can all be done remotely.

| <b>Instrumentation</b>  | <b>Description</b>  |
|---|---|
|  | <p>K-Patents Sanitary Compact Refractometer PR-23-AC for small pipe line sizes of 2.5 inch and smaller.</p> <p>The PR-23-AC sensor is installed in the pipe bend. It is angle mounted on the outer corner of the pipe bend directly, or by a flow cell using a 3A Sanitary clamp or Varivent® connection.</p> |
| Measurement range:  | Refractive Index (nD) 1.3200 – 1.5300, corresponding to 0-100 Brix.   |