PRECONDITIONER

KoEx manufactures a range of preconditioning cylinders for the preparation of uniformly mixed and hydrated powders for supply of extrusion cooking systems.

Preconditioner Installation in Typical Snack foods Application

The facility to supply live steam injection into the process can be provided as required. The Preconditioner is manufactured from 304 Stainless Steel, 2B finish, heavy section rolled sheet, complete with S/S agitator shaft and adjustable paddles driven by a 2.2KW, S/S painted IP66 motor gearbox mounted on Thermoplastic bearing housings and S/S self lubricating bearings.

Provision of stator pins to enhance mixing characteristics and minimize product hang-up, Water addition will occur through a single injection port at the top of the vessel, steam addition will occur through 5 separately manually adjusted injection ports. Steam supply will be through a common manifold.

Preconditioning is a unit operation that has long been associated with Extrusion Processing, indeed many other cereal processing methods, e.g. Pellet Milling. Although a seemingly simple process, there are many design variants available. There are also a number of operational parameters that need to be given careful consideration when selecting and / or designing a process application.

The following short discussion seeks to present some of the key design and process control criteria, such that the process optimisation exercise may be completed in a less empirical manner.

Objective

The primary objective of the Preconditioning in an extrusion cooking process is to initiate the “Hydration” and the “Cooking” processes. In this discussion, cooking is the generic term used to describe the various material transformations that are occurring within the product formulation during its time within the extrusion system.

It is well known that the rate of progress of the Cooking Reaction (or the Degree of Cook, as it is often referred to) is controlled via **Cook = f [Time, Temperature, Pressure]**

This simple relationship highlights the key variables in this important process. All of the other variables (mostly Geometrical in nature), that can be used to differentiate the various types of Preconditioners, in reality, impact upon the uniformity of the Material Conveying within the process. The geometry has a major impact upon the Mixing Characteristics within the system.

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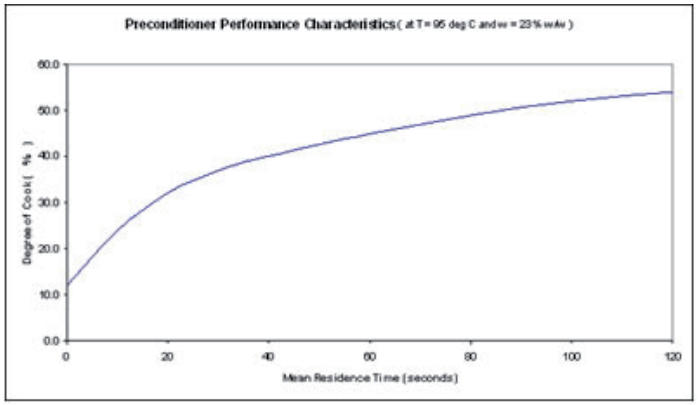
PRECONDITIONER

The physical dimension of the Preconditioner (and the Paddle Configuration and / or the presence of a Weir) are the key process variables that control the Process Time (or more specifically the Residence Time Distribution).

The uniform mixing typically achieved within the Preconditioner ensures a rapid, consistent dispersion of the various ingredients of the formulation. The key components are the Water and / or Steam.

The relationship between the Degree of Cook and the Mean Residence Time (at a Product Temperature, T = 95^{o}C) is presented in the Figure.



Relationship between Degree of Cook and Mean Residence Time

Benefits of Preconditioning

All of the Preconditioner equipment suppliers regularly espouse the benefits of this technology.

Process Improvements Gained Via the Use of Preconditioning

- Improved Product Uniformity
- Higher Output (from a given Extruder size)
- Efficient Heating
- Reduced Wear of Extruder Components
- Improved Process Stability
- Reduced Requirement for Starch in the Formulation
- Improved “Cook”
- Improved Digestibility
- Improved Water Absorption (as measured via WAI or 'Bowl Life')
- Reduced Water Solubility (as measured via WSI)

A large number of different types of Preconditioner are available on the market. The type to be used depends upon the application. The capital investment required varies significantly, depending upon the chosen design.

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