

Formulating Hydrocolloid Skin Barriers for pH Control

Michael Taylor
Principal Research Scientist

Hollister Incorporated, Libertyville, Illinois USA

Abstract

Tazawa and coworkers (1) have written extensively on the importance of maintaining the pH under Ostomy skin barriers in the physiologically desirable range (pH 4 to pH 5.5). In Hydrocolloid skin barriers, the pH under the barrier is controlled by the hydrocolloid components which can swell and partially dissolve on exposure to fluid. Selecting the correct hydrocolloids can provide a pH at the skin surface that is in the desirable range. Furthermore, hydrocolloid blends can be used to yield pH buffer systems that not only produce a particular pH, but also help maintain that pH when challenged by either alkaline or acidic fluids.

This presentation will review the properties of hydrocolloids that are important in determining their influence on pH and demonstrate how an understanding of these properties enables the selection of components to produce skin barriers with the needed pH control characteristics. It is important to consider how the various components in skin barriers interact to influence pH control, rather than considering individual components in isolation. In addition, the choice of the specific hydrocolloids and the amounts of each used in a skin barrier will influence other critical skin barrier properties, such as adhesiveness and fluid absorption properties. Thus, we need to think of skin barrier formulations as systems rather than focusing on individual components.

Acid Mantle of the Skin

- The pH of healthy skin is actively regulated in the pH range from 4 to 5.5.
- Maintaining pH in this range is important for many skin functions.
- There are two functions that are especially important for ostomy patients:
 - Antimicrobial defense
 - Inactivation of faecal enzymes

Acid Mantle of the Skin

Antimicrobial defense

- Microbes that make up the normal flora of the skin are well adapted to growth in acid pH.
- Other organisms, including pathogenic species, do not proliferate well at this pH.
- Maintaining pH at the normal range is preferred to support the normal flora and inhibit other microbes.

1. Skin Barriers for Stoma Care - From Basic Therapy to Clinical Application, Supervised by Tazawa K. and edited by Anazawa S., Ohmura Y. and Yoshikawa R., 2001.



Acid Mantle of the Skin

Inactivation of faecal enzymes

- Faecal output from the stoma contains active digestive enzymes.
- These enzymes, especially the proteolytic enzymes, are irritating and damaging to skin.
- Enzyme activity is generally pH-dependent and most of the digestive enzymes are active near neutral pH.
- Enzymatic degradation of the skin by these enzymes is inhibited at normal skin pH.

What is a pH Buffer?

- A buffer is made by blending a weak acid with a weak alkali.
- This combination provides both acidic and alkaline components that can neutralise added acids or alkalis.
- Pectin is a weak acid; CMC is a weak alkali.
- Selecting the right combination of CMC and Pectin gives a pH buffer at the desired pH value.

Summary and Conclusions

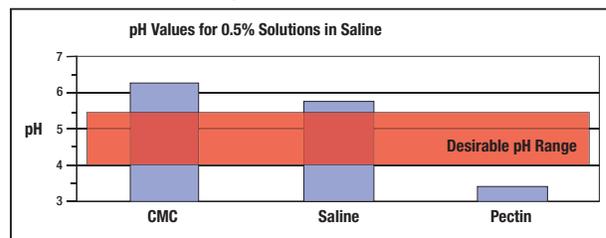
- Normal skin pH is slightly acidic
- Two important features are influenced by pH:
 - The growth of non-resident microbes on the skin
 - Faecal enzyme activity
- We can select hydrocolloid combinations that provide pH control and pH buffering in the pH range of normal skin

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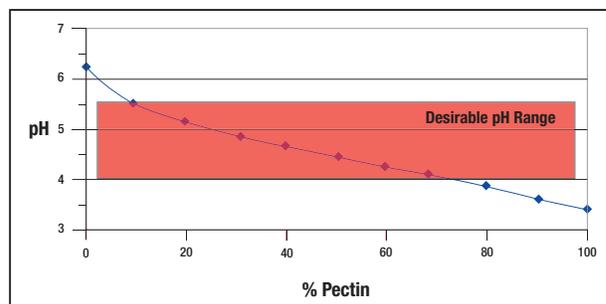
pH Values for Individual Hydrocolloids

CMC Increases the pH of saline - CMC is a weak alkali
Pectin Decreases the pH of saline - Pectin is a weak acid



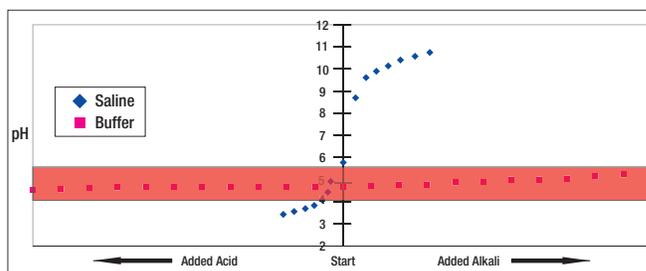
Adjustment of pH with mixtures of Pectin and CMC

Solutions made with mixtures of CMC and Pectin show pH values between the values found for the individual hydrocolloids. Several mixtures have pH values in the desirable range.



CMC - Pectin Buffer Resists Acid and Alkali

With no buffer, normal saline solution changes pH dramatically when challenged by either acid or alkali. The CMC - Pectin buffer system starts at the right pH and resists changes in pH over a wide range of acidic or alkaline challenges.



Hollister Incorporated
2000 Hollister Drive
Libertyville, Illinois 60048 USA
1.800.323.4060

Distributed in Canada by
Hollister Limited
95 Mary Street
Aurora, Ontario L4G 1G3
1.800.263.7400

www.hollister.com