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Investigating The Chemical Composition And Ph Reactions Of Commercial Menstrual Pads: Implications For Vaginal Health

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I. Introduction:

Menstrual hygiene products, particularly sanitary pads, are widely used globally to manage menstruation. However, concerns have been raised about the chemical composition of these products and their potential effects on women's health, particularly the vaginal environment. The vaginal pH, typically ranging from 3.5 to 4.5, plays a crucial role in maintaining a healthy microbiome and preventing infections. This study aims to investigate

the chemical reactions of four commonly used commercial pad brands—Stayfree, Sofy, NUA, and Whisper—by analyzing their pH levels and reactivity with various chemicals. By understanding these chemical properties, this research seeks to assess the potential risks of using such products on vaginal health.

II. Materials And Methods:

Four types of menstrual pads (Stayfree, Sofy, NUA, and Whisper) were tested for their chemical composition and pH reactions. The following materials were used in the experiment:

- Pads from each brand (Stayfree, Sofy, NUA, Whisper)
- Solvents: Distilled water, hydrogen peroxide, sodium bicarbonate ($NaHCO_3$), hydrochloric acid (HCl), sodium hydroxide (NaOH), benzoic acid(C_6H_5COOH)
- pH indicators (Universal pH paper)

Procedure:

1. **Chemical Extraction**: Pads were cut into small pieces and soaked in distilled water at room temperature for 24 hours. Observations were made for visible changes or crystallization after soaking.
2. **pH Measurement**: The pH of the soaked pad solution was measured using universal pH indicators.
3. **Reactivity with Acids and Bases**: The pH of the solution was then measured after the addition of NaOH (base), HCl (acid), and $NaHCO_3$ (bicarbonate salt). Additionally, the reaction of the pad extracts with hydrogen peroxide was observed for any visible changes or oxidation-reduction reactions.
4. **Data Recording**: pH values were recorded immediately after each reaction and after one minute for consistency. The pH was also monitored for any time-dependent changes.

III. Results:

pH of Soaked Solutions

Company	pH of soaked solutions
Stayfree	8
Sofy	9
NUA	8
Whisper	9

pH after reaction with Sodium Hydroxide (NaOH)

Company	pH after reaction with NaOH
Stayfree	10
Sofy	14
NUA	10
Whisper	12

pH after reaction with Hydrochloric Acid (HCl)

Company	pH after reaction with HCl
Stayfree	1
Sofy	1
NUA	1
Whisper	3

pH after Reaction with Sodium Bicarbonate ($NaHCO_3$)

Company	pH after reaction with $NaHCO_3$
Stayfree	1
Sofy	1
NUA	1
Whisper	1

pH after reaction with Hydrogen Peroxide (H_2O_2)

Company	pH after reaction with H_2O_2
Stayfree	6
Sofy	6
NUA	6
Whisper	6

pH after reaction with Benzoic Acid (C_6H_5COOH)

Company	pH after reaction with C_6H_5COOH	Comments
Stayfree	6	Alkaline substances in pad react with benzoic acid, lowering pH.
Sofy	6	Stronger alkalinity, more significant pH decrease.
NUA	7	Mildly alkaline, pH drops towards neutral.
Whisper	7	Alkaline substances react, causing a pH drop.

IV. Discussion:

The presence of alkaline chemicals in the pads suggests that they may contain substances like sodium bicarbonate, surfactants, or other compounds used to enhance absorbency or stability. Alkaline pH levels are often associated with materials that are intended to neutralize odor, absorb moisture, or stabilize the structure of the pad. A high initial pH after soaking, as seen in most of the brands, may indicate the presence of alkaline additives used in the production process. The significant increase in pH after exposure to NaOH, particularly in Sofy, further reinforces the presence of reactive alkaline substances that could be linked to their manufacturing process.

On the other hand, the highly acidic environment observed after the addition of hydrochloric acid (HCl) suggests the pads contain chemicals that are prone to react with acids. The significant drop in pH across all pad brands indicates the presence of substances that neutralize acids, which could have implications for the vaginal pH balance. A highly acidic environment in the vaginal area can lead to irritation, discomfort, and possible disruption of the natural vaginal flora, increasing the risk of infections or inflammation.

The reaction with sodium bicarbonate, which produced a pH of 1 in all pads, indicates that the products may contain substances that strongly react with weak acids or salts, potentially leading to further acidification. This could be a cause for concern regarding prolonged exposure to these materials, as continuous acidic reactions could alter the vaginal pH and disrupt its natural balance. Excessive acidification in the vaginal environment may affect the healthy bacterial flora that helps maintain the area's natural defenses.

The fact that hydrogen peroxide did not result in significant pH changes suggests that oxidative reactions were not the primary concern for these pads. Hydrogen peroxide is typically used in disinfection processes, but the lack of a reaction may indicate that the chemical composition of the pads is not highly oxidizing or reactive in this context.

Therefore, the primary concern for vaginal health appears to stem more from the acidity or alkalinity of the materials used in the pads rather than from oxidation-reduction processes.

In summary, the alkaline nature and reactivity of the chemicals present in the pads, as well as the highly acidic environment formed during the experiment, suggest that these products may disrupt the natural pH balance of the vagina. This disruption can lead to discomfort, irritation, and a higher risk of infections, highlighting the importance of investigating the chemical composition of menstrual products for potential health risks.

Benzoic acid was used to mimic vaginal pH, which typically ranges between 3.8 and 4.5. A 0.1 M solution of benzoic acid (pH 2.8–3.0) was added to the pad extracts to observe the interaction with the alkaline chemicals present. All pad extracts showed a significant pH decrease, dropping to around 6-7, indicating the

neutralization of alkaline substances in the pads. This suggests that chemicals like sodium bicarbonate might be present, which could disrupt the natural acidic pH of the vagina if in prolonged contact. Further studies could explore the impact of such chemical interactions on vaginal health.

V. Conclusion:

The experiment revealed significant variations in the pH and chemical reactivity of different pad brands, with most exhibiting alkaline properties. The reaction with hydrochloric acid, sodium bicarbonate, and benzoic acid suggested the presence of alkaline chemicals that could potentially disrupt the natural acidic pH of the vagina. These findings highlight the need for further research into the chemical composition of menstrual products and their impact on vaginal health. Prolonged exposure to such substances may alter the vaginal environment, potentially leading to discomfort or infections. Therefore, it is crucial to consider safer, more natural alternatives for menstrual products.