



Parabens as Preservatives in Personal Care Products

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Abstract: *Parabens are most commonly used preservatives in cosmetics, pharmaceuticals and industrial products. The use of parabens in cosmetics as preservatives was considered safe but recent studies suggest that they are harmful. The present work was a preliminary investigation on the presence of the preservative parabens in commonly used skin care products and to study their antimicrobial effects. It was concluded that many skin care products use paraben as preservative and they show antimicrobial activity against yeast. However, to know about their harmful effects, further research is needed.*

Keywords: *Parabens, skin care products, methylparaben, yeast.*

Introduction:

The use of skin creams and body lotions has become a common feature in our day to day life. These products are usually packed in small pots. The cream is applied with the fingers and we do not wash our hands every time before creaming our skin. Therefore, germs from the hand get into the cream pots. The conditions of cream pot is optimal for rapid microbial growth of the germs, as the creams often contain a lot of water and are kept in warm bathrooms. Hence, to avoid spoilage of the cream, preservatives are added to nearly every skin cream or body lotion. Without preservatives, the germs would accumulate in the cream and spread, which finally would cause skin problems or even dermatitis. Parabens are one of the most common preservatives used in cosmetic products. They are used in a wide variety of products including shampoos, lotions, deodorants, scrubs and eye makeup. Parabens are, however, critically perceived and discussed in the public and in the media. Reports are available in newspapers about the estrogenic effects of parabens, which are then connected to speculations on fertility problems in men and the promotion of breast cancer in women (Daily Mail, 2012).

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The antimicrobial activity of parabens was first studied in the 1920 by Theodor Sabalitschka. Since that time, parabens became used worldwide in foods, cosmetics, detergents and medicines to protect them against moulding. Parabens are white, odourless, fine crystalline substances. A strong metallic taste occurs at concentrations above 0.08%, hence, it is not used in higher concentrations in food products. The parabens do not discolour cosmetic products and are inexpensive to manufacture. Parabens are effective preservatives that work well in a wide pH-range from 4.5 - 7.5. Parabens are quite resistant against hydrolysis and are stable in the temperature ranges required for the production of cosmetics. The good stability against external conditions, combined with quite low costs of production, explains why parabens are so commonly used (Böhm and Sabalitschka, 1941).

Literature Review:

Parabens are a class of preservatives widely used in pharmaceuticals, food products, personal hygiene products, and the cosmetic industry. These chemicals successfully prevent the growth and development of yeast, bacteria, and fungi which may spoil and ruin the products. With scientifically-proven reproductive systems and endocrine system disruption from long-term exposure, it is widely accepted that long-chain parabens should not be added in cosmetic or personal care products. When parabens get inside the body by skin absorption, the harmful ingredient continues to stay in the epidermal tissue. This is known to adversely impact the natural hormonal activities in our body. Parabens have the capability to mimic natural hormones of the human body. Due to this activity, our body may treat parabens in the same way as hormones.

Usage of parabens may affect our skin in different ways including

- With prolonged use, parabens may cause dry skin conditions in individuals.
- The exposed skin may develop rash, swelling, pain, cracks, and various other issues.
- Parabens may also lead to contact dermatitis, a severe skin inflammation accompanied with burning skin, blisters, and rashes.
- Long-term exposure to parabens may also lead to the appearance of premature signs of aging such as wrinkles, fine lines, and age spots.
- One specific type, methylparaben increases the skin's sensitivity to sunlight that leads to faster cell death and nitric oxide production.
- A similar study suggested that skin damage from exposure to sunlight while using a product containing methylparaben might lead to the formation of cancer. This may be due to the oxidative DNA damage that it could cause (Byford et al., 2002).

A British study, conducted in 2004, discovered trace amounts of at least five parabens in the breast tissue of women. Scientists are concerned about the exposure to environmental estrogens and how they may contribute to the risk of breast cancer in women. Propylparaben can alter the expression of genes, including those in breast cancer cells (Wróbel and Gregoraszczuk, 2014), and accelerate the growth of breast cancer cells (Okubo et al., 2001). A recent University of California-Berkeley study found that low doses of butylparaben, previously not considered harmful, worked in conjunction with other cell receptors to switch on cancer genes and increased the growth of breast cancer cells (Pan et al., 2016).

Parabens are also linked to ecological harm, as low levels of butylparaben can kill coral, according to laboratory tests (Danovaro et al., 2008). Parabens have been detected in surface waters, fish and sediments (Haman et al., 2015). When parabens are combined with chlorinated tap water, several chlorinated paraben byproducts can form (Canosa et al., 2006). Little is known about the toxicity of these byproducts, which may be more persistent (Haman, 2015).

Hypothesis:

Parabens are commonly used preservatives in cosmetics, pharmaceuticals and industrial products. The use of parabens in cosmetics as preservatives was considered safe but recent studies suggest that they are harmful and oestrogenic. They also have adverse effect on reproductive system. These chemicals enter the body subcutaneously. Therefore, further research work should be done to establish the exact nature of parabens.

Objectives:

The aim of present study is to extract the parabens from personal care products and see the different effects of it in order to determine its positive and negative aspects. Accordingly, the objectives of present investigation include:

- Extraction of parabens from the selected samples that included personal care products namely, GOOD VIBES toner, GOOD VIBES sunscreen, Fair & Lovely face wash, Fair & Lovely cream, Lakme moisturizer, Vaseline body lotion
- Detection of parabens
- Effects of paraben in an agar patch test
- Effects of paraben on yeast

Materials and Method:

Materials Required : Chemicals: Ethanol, Methanoic acid, Potassium ferrocyanide, Zinc

sulfate, Ferric trichloride, Calcium hydroxide, Glucose, Agar-agar powder, Yeast, Distilled water.

Glass wares: Test tube, Petri dish, Beaker, Funnel.

Miscellaneous: Glass rod, Spirit lamp, Cotton, Test tube stand, Test tube holder, Spatula, Filter paper, Dropper, Pipette.

Instruments: Electronic weighing machine, pH meter.

Methodology : The methodology of the present research work is as follows:

Extraction of parabens from the selected samples: The parabens were extracted from the selected samples by the method described by Kruijf et al., (1989). 3 g of a commercial cream was heated and stirred in a solution of 30 mL ethanol and 1.5 mL Methanoic (formic) acid ($c = 4 \text{ mol/L}$) to 70°C . The result was a milky solution that was clarified by the addition of 2 mL Carrez I and II (Fig. 1). Carrez I is a solution of potassium ferrocyanide (15 g dissolved in 10 ml water) and Carrez II a solution of zinc sulphate (30 g dissolved in 100 ml/water). The result is potassium-zinc hexacyanoferrate (II) ($\text{K}_2\text{Zn}_3[\text{Fe}(\text{CN})_6]_2$), which binds the colloidal proteins. The solution was allowed to stand until phase separation (Fig. 2). The supernatant liquid was filtered off.



Fig. 1. Carrez I and II is mixed



Fig. 2 Filtered out samples after phase separation

Paraben detection

Ingredients: 1 Cotton swab, 2 Disposable plastic cups, 1 Petri dish, Rubbing alcohol (a.k.a.: ethanol), Water (preferably de-ionized), Parabens Indicator: Ferric trichloride.

Parabens testing procedure

1. A small amount (1/8 of a teaspoon) of the sample (sunscreen, toner, cream, face wash, body lotion, and moisturizer) is placed in one cup of rubbing alcohol and stirred until it dissolved.
2. A cotton swab was lightly soaked with alcoholic test solution.
3. The swab was air dried to evaporate the alcohol.
4. In a cup a ¼ teaspoon of paraben indicator was mixed with one cup of water. This solution was labeled as 'indicator'.
5. On a Petri dish, a drop of indicator was placed (Fig. 3).
6. The dried test swab was dipped into the drop.
7. Steps 5 and 6 were repeated with a clean (untreated) swab which served as reference to distinguish the color change.



Fig. 3 Paraben test

Results and Discussion:

No changes were detected in GOOD VIBES toner and sunscreen (Fig. 4 (a) and (b)) and Vaseline body lotion indicating them to be paraben free samples.

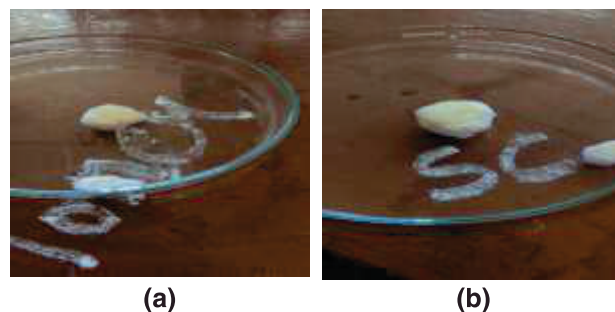


Fig. 4. Parabens free samples (a) GOOD VIBES toner; (b) GOOD VIBES sunscreen

The colour of the cotton swab changed into orange to brown colour in presence of methylparaben. Colour change were seen in some of the other samples namely, Fair & Lovely cream, Fair & Lovely face wash (Fig. 5 (a) and (b) and Lakme moisturiser that contained paraben as preservative.

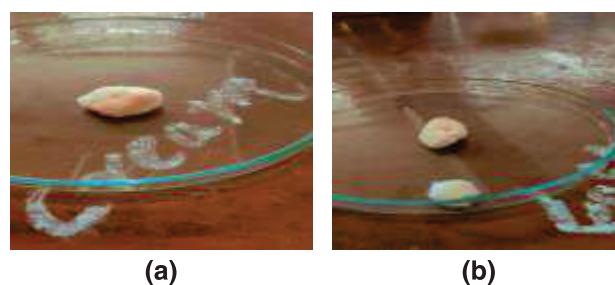


Fig. 5. Colour changed to orange (a) Fair & Lovely cream; (b) Fair & Lovely face wash

The results are tabulated in Table 1.

Table 1. Result of paraben presence test

Sl. No.	Sample	Paraben	Colour
1.	Good vibes sunscreen	absent	No change
2.	Fair&lovely face wash	present	Changed (orange)
3.	Fair&lovely cream	present	Changed (orange)
4.	Good vibes toner	absent	No change
5.	Vaseline body lotion	absent	No change
6.	Lakme moisturiser	present	Changed (orange)

The colour changes can be observed after the paraben presence test. Samples in which methyl paraben are used as preservative changed into orange to slight brown colour. No changes were detected in samples which did not contain paraben.

Effect of parabens in an agar patch test

- 6 g of agar-agar powder was boiled with 100 ml water.
- Half-half of the viscous liquid was poured in two Petri dishes and then cooled to form agar plates.
- In one Petri dish, few drops of preservatives were added.
- Another Petri dish was free from preservatives and used as control.

Observations were recorded on day 2, 4, 6 and 8, respectively.

Observation: The Petri dish, in which preservative was added, did not show any damage while the Petri dish without preservative was contaminated with the growth of microbes. This indicates that preservatives help to protect the product for longer use but as some studies suggest

that parabens are harmful for human health, it will show harmful effects on human health in future.

Effects of parabens on yeast

$\frac{1}{2}$ cube (teaspoon) of baker's yeast, 2-3 teaspoons of glucose and 80 ml of warm water were mixed. Yeast activity was visible through foaming or tested for with lime water. Bubble formation and foaming shows the production of carbon dioxide.

Drops of diluted solutions of paraben were added and the solution was well mixed. A nonpreserved sample was prepared as control.

Observation: It was observed that when drops of non-preserved sample (control) were added to the yeast solution, foaming continued, but when diluted solutions of paraben were added, then the solution became clear indicating termination of carbon dioxide production (Fig. 6 (a) and (b)). Parabens damage the yeast cells, so that the carbon dioxide production was terminated.

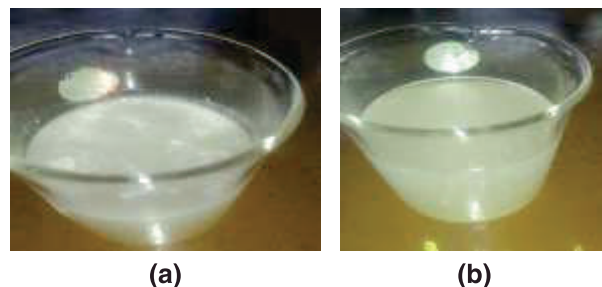


Fig. 6. (a) Addition of paraben free sample; (b) Addition of diluted solutions of paraben

Conclusion:

Parabens are most common preservative used in cosmetics due to good stability against external conditions (pH and temperature) combined with low cost of production.

The present study on the effects of parabens on yeast cells showed that the parabens damaged the yeast cells. The cellular biology of yeast cells and human cells is remarkably similar.

Thus it can be concluded that the use of cosmetics with parabens as preservative can be harmful to the epidermal cells of human beings in the long run and should be avoided.

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