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THE CHEMICAL COMPOSITION OF PARABEN AND ITS EFFECTS ON HEALTH

Parabens are a group of alkyl esters of p-hydroxybenzoic acid and usually include methyl paraben, ethyl paraben, propyl paraben, butyl paraben, isobutyl paraben, isopropyl paraben and benzyl paraben. Parabens (or their salts) are widely used as preservatives in cosmetics and medicine due to their relatively low toxicity and long history of safe use. Testing of parabens has shown, to varying degrees, that individual paraben compounds have weak estrogenic activity in some in vitro screening tests, such as estrogen receptor ligand binding, regulation of CAT gene expression, and proliferation of MCF-7 cells. Reported in vivo effects include uterine weight gain (eg, butyl, isobutyl, and benzyl parabens) and male reproductive tract effects (eg, butyl and propyl parabens). However, in relation to estrogen as a control during in vivo studies, parabens are much less active than estrogen. While exposure to sufficient doses of exogenous estrogens can increase the risk of certain adverse effects, it is hypothesized that similar risks may arise from exposure to much weaker endocrine-active chemicals (EACs) is still speculation. In evaluating the possibility that exposure to weakly active EACs may be associated with adverse effects due to their endocrine mode of action, it is important to consider both the dose and potency of these compounds compared to estrogen. In this review, a comparative approach involving dose and potency is used to assess whether in utero or adult exposure to parabens may be associated with adverse effects due to their estrogen-modulating mode of action.

Keywords: parabens, p-Hydroxybenzoates, PHBA, paraben applications, Methyl paraben.

Introduction

Parabens or p-Hydroxybenzoates are derivatives of p-hydroxybenzoic acid, which are used as preservatives and antimicrobial compounds in the industry, especially in the pharmaceutical, cosmetic and food industries, due to their attractive properties. The enormous development of analytical techniques in recent years has led to the possibility of detecting compounds at very low concentrations. However, in reality, the presence of these types of emerging compounds has increased in ecosystems and has negative effects on the environment, animals and even humans [in fact, parabens can act as endocrine disruptors that can cause risks. Increasing adverse health in organisms is also associated with destructive behavior. These diagnoses can be explained by the increase in paraben in the composition. Parabens are flammable compounds and accumulate easily in nature. This work examines the properties that make parabens valuable, the unique problem for human health in this area, the use of these compounds and the risks associated with them are analyzed. Features, the effect of parabens on humans, animals and the ecosystem is a topic that is raised in scientific societies, and some reports indicate that these compounds are carcinogenic. The presence of parabens in ecosystems, the risks related to their use were considered through the evaluation of toxicological studies on different species and also humans.

Materials and methods: Bibliographic research, this article is About parabens, properties, and its effects on health, how to spread it in the environment, in this research, authentic books and articles have been used to fill the gaps in the subject. (Books, journals, practical research, websites, etc.)

What is paraben? $\text{CH}_3(\text{C}_6\text{H}_4(\text{OH})\text{COO})$

Para hydroxyl benzoates or parabens are man-made chemicals that inhibit the growth of mold and bacteria. These unnatural substances are commonly used to maintain the quality of cosmetics, drugs, foods, beverages, and personal care products. The presence of paraben in these products increases their life and quality [10].

After the discovery of these substances in the cancer cells of people with breast cancer, its use became very controversial and researchers investigated the effects of parabens in the body. Research has shown its destructive effects on the functioning of hormones in the body. Based on the obtained results, paraben can cause changes in cholesterol, blood sugar, thyroid and immune system function. Also, the risk of allergies, obesity and infertility increases with the use of parabens. Of course, this research is limited to animal and cell studies, and more opportunities and research are needed in this field to discover more accurate results. According to the American Food and Drug Administration, the existence of a low and standard percentage of parabens in various products does not prevent it [1].

History of parabens: The antimicrobial effect of parabens and their use as preservatives was first identified in 1924 by Sabalitschka [9].

In 1984, the CIR reviewed the safety of parabens used in cosmetics and concluded that they are safe even in very high doses. Parabens are typically used at levels of 0.01 to 0.3 percent, and the CIR concluded that they are safe for use in cosmetics up to 25 percent. In 2012, CIR reopened its safety report on parabens to take into account all new data. As it did in 1984, the panel reaffirmed the safety of cosmetic products containing paraben preservatives.

What products contain parabens?

Before examining the effects of parabens, it is better to know what products these chemicals are used in? and what is the reason for this [1]?

Parabens are found in a wide range of products that require preservatives, especially those that contain a lot of water, such as the shampoos and conditioners are bases that most people use it in their daily live. The antimicrobial properties of this chemical against fungi and warm bacteria have attracted the attention of manufacturers. Regardless of the effects of parabens, they are commonly used in the manufacture of moisturizers, face and skin cleansers, sunscreens, deodorants, shaving gels, toothpaste, most cosmetics, and skin and hair care products. These substances are absorbed by the body through the skin, metabolized and finally excreted through urine and bile. If the amount of paraben absorbed by the body is small, there is no problem and the body removes it easily, but the daily use of one or more products containing paraben and continuous exposure to these substances in the long term affects our health. puts [3].

Meanwhile, the products we use as daily care contribute the most to the entry of parabens into the body. The use of body and face lotions, hair products, sunscreens and cosmetics all significantly increase the level of this harmful substance in the body and intensify the effects of parabens [5].

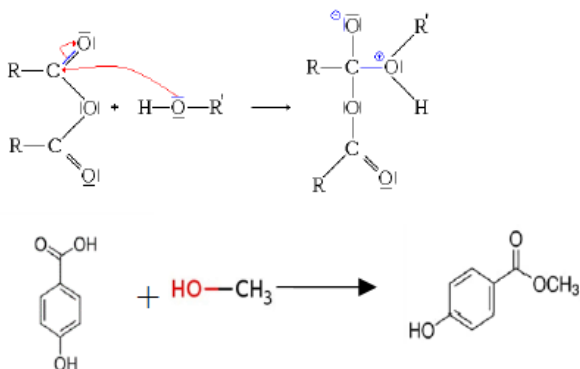
According to studies comparing paraben levels in the bodies of women, men, teenagers and children, people who regularly and daily use cosmetic products have 20 times more than people who never or rarely use makeup. Do this, paraben has been excreted in their urine, this amount is significant and alarming [8].

Results and discussion

Based on the results obtained: The amount of paraben in the urine of women was higher than that of men, People 20 years and older had higher paraben levels, Asians had the highest levels of butyl and ethyl paraben in their results, in this part of the article, we will introduce you to the effects of parabens with different types of this chemical [8].

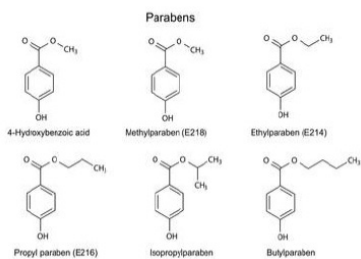
Parabens are made from para-hydroxybenzoic acid (PHBA), PHBA is an acid often found in bacteria, plants and fruits [6].

According to the following interaction, Parabens are made from an acid-base chemical reaction called esterification. When PHBA and alcohol are combined, they form an ester. Esters differ based on the number of chemical bonds in the molecule. The type of alcohol used in this process determines the number of esters. The more and longer the ester bonds, the more active the substance becomes, and as a result, the side effects of parabens increase. During this chemical process, substances with the following names are produced [7].



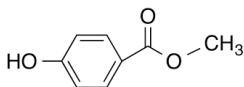
Types of parabens

- † Methyl paraben (methanol)
- † Ethyl paraben (ethanol)
- † Pentylparaben (Pentanol)
- † Butyl paraben (butanol)
- † Heptyl paraben (heptanol)
- † Benzyl paraben (benzyl alcohol)
- † Pentyl paraben (pentyl alcohol)
- † propyl paraben (n-propanol)
- † Isobutyl paraben (iso butanol)
- † Isopropyl paraben (isopropanol)



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What is methyl paraben?



Methyl paraben is a white powder with the chemical formula $\text{CH}_3(\text{C}_6\text{H}_4(\text{OH})\text{COO})$ and its other name is Nepagen. actually we can see this is a type of paraben. Parabens are chemicals that are often used as preservatives to make products last longer. This substance occurs naturally in a handful of fruits, such as blueberries, although it can also be present in combinations. This substance is present in cleansers and moisturizers, from creams to raw materials, and helps to maintain the effect of these products.

Its benefits: Prevents the growth of fungus, it preserves the material, Anti-bacterial [2].

What are its uses? Methyl paraben is used in a wide range of cosmetic products

- † make up products.
- † Cleaning products.
- † Hair care products.
- † Moisturizers.
- † Some deodorant.



Figure 1 – Information about ingredients containing parabens [4]

Dangers and side effects of methyl paraben: There are different opinions about the safety of this substance, but the Food and Drug Organization considers its use in cosmetics and food products to be safe and harmless.



Figure 2 – Information on the effects of ingredients containing parabens

Possible allergic reactions: Some people have reported allergies to this substance. This substance is not irritating for people who do not have sensitive skin, but products containing Nepagen accelerate the aging process of the skin. Complications that may appear on the skin include, Itching, Blister, Dry and scaly skin, Burning and swelling. If it comes into contact with the eyes, it may cause redness or swelling of the eyelid [4].

Conclusions

This work examines the role of parabens in daily life and examines the characteristics of parabens, properties, detection in different sources and organisms, toxicological studies, risks for humans and animals, laws and regulations, parabens because They are widely used in various applications. Domain. Their features that make these products suitable solutions. However, as mentioned, the effects of these compounds on human health can be problematic. However, parabens have already been detected in various human tissues, organs and fluids, mainly due to the use of pharmaceuticals and personal care products. In fact, the increase in consumption of such products causes more release in domestic sewage. Moreover, these compounds have been widely detected in various water sources. This presence shows that conventional methods cannot be used as an effective treatment technology to reduce them. Therefore, it can be concluded that parabens are found in numerous sources and organisms around the world, the impact on animals, especially in aquatic species, can be of concern because different species can suffer different negative effects, which are mainly related to parabens that they behave It disrupts the endocrine glands. Some reported studies show that they can affect the reproductive system of animals and reduce their population, as well as cause other species and health problems. Its impact on the ecosystem is difficult to measure, but other species can be affected. In general, it can be concluded that the laws related to the use of parabens in industries are changing and being updated, and the use of some parabens is currently prohibited. or is under severe restrictions. More studies are needed to uncover the true role of parabens in human and ecosystem health so that adequate regulation can be implemented. In addition, appropriate treatment technologies should be developed to remove such persistent compounds from usable materials in order to protect health and the environment.

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ПАРАБЕНДІҢ ХИМИЯЛЫҚ ҚҰРАМЫ ЖӘНЕ ОНЫҢ ДЕНСАУЛЫҚҚА ӘСЕРІ

Парабендер р-гидроксibenзой қышқылының алкил эфирлерінің тобы болып табылады және әдетте метилпарабен, этилпарабен, пропилпарабен, бутилпарабен, изобутилпарабен, изопропилпарабен және бензилпарабенді қамтиды. Парабендер (немесе олардың тұздары) салыстырмалы түрде төмен уыттылыққа және қауіпсіз пайдаланудың ұзақ тарихына байланысты косметикада, гигиеналық

құралдарда және фармацевтикада консерванттар ретінде кеңінен қолданылады. Парабенді әртүрлі дәрежеде сынау жеке парабен қосылыстарының эстроген рецепторларымен лигандтармен байланысуы, SAT генінің экспрессиясын реттеу және MCF-7 жасушаларының пролиферациясы сияқты кейбір *in vitro* скрининг сынақтарында әлсіз эстрогендік белсенділікке ие екенін көрсетті. *In vivo* хабарланған әсерлерге жатырдың салмағының жоғарылауы (яғни бутил-, изобутил- және бензилпарабен) және ерлердің ұрпақты болу жүйесіне әсерлері (яғни бутил- және пропилпарабен) жатады. Алайда, *in vivo* зерттеулері кезінде бақылау құралы ретінде эстрогенге келетін болсақ, белсенділігі бар парабендер эстрогенге қарағанда белсенді емес. Экзогендік эстрогеннің жеткілікті дозаларының әсері кейбір жанама әсерлердің қаупін арттыруы мүмкін болса да, ұқсас тәуекелдер әлдеқайда әлсіз эндокриндік белсенді химиялық заттардың (ЕАК) әсерінен де туындауы мүмкін деген болжам әлі де болжамды болып табылады. Әлсіз белсенді АТК әсерінің эндокриндік әсер ету механизміне байланысты жанама әсерлерімен этиологиялық байланысты болуы ықтималдығын бағалау кезінде эстрогенмен салыстырғанда мұндай қосылыстардың дозасын да, потенциалын да ескеру өте маңызды. Бұл шолуда парабендердің жатырда немесе ересек жаста әсер ету эстрогенді модуляциялаушы әсер ету механизмі арқылы болатын жанама әсерлермен байланысты болуы мүмкін екенін бағалау үшін дозаны да, потенциалды да қоса алғанда салыстырмалы тәсіл қолданылады.

Кілтті сөздер: парабендер, *p*-гидроксibenзоаттар, POBA, парабенді қолдану, метилпарабен.

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ХИМИЧЕСКИЙ СОСТАВ ПАРАБЕНА И ЕГО ВЛИЯНИЕ НА ЗДОРОВЬЕ

*Парабены представляют собой группу алкиловых эфиров *n*-гидроксibenзойной кислоты и обычно включают метилпарабен, этилпарабен, пропилпарабен, бутилпарабен, изобутилпарабен, изопропилпарабен и бензилпарабен. Парабены (или их соли)*

широко используются в качестве консервантов в косметике, туалетных принадлежностях и фармацевтических препаратах из-за их относительно низкой токсичности и долгой истории безопасного использования. Тестирование парабенов в различной степени показало, что отдельные соединения парабенов обладают слабой эстрогенной активностью в некоторых скрининговых тестах *in vitro*, таких как связывание лиганда с рецептором эстрогена, регуляция экспрессии гена CAT и пролиферация клеток MCF-7. Сообщаемые эффекты *in vivo* включают увеличение веса матки (т.е. бутил-, изобутил- и бензилпарабен) и воздействие на мужскую репродуктивную систему (т. е. бутил- и пропилпарабен). Однако в отношении эстрогена в качестве контроля во время исследований *in vivo* парабены с активностью на много порядков менее активны, чем эстроген. В то время как воздействие достаточных доз экзогенного эстрогена может увеличить риск некоторых побочных эффектов, предположение о том, что аналогичные риски могут также возникать в результате воздействия эндокринно-активных химических веществ (ЕАС) с гораздо более слабой активностью, все еще является спекулятивным. При оценке вероятности того, что воздействие слабоактивных АПЦ может быть этиологически связано с побочными эффектами из-за эндокринно-опосредованного механизма действия, крайне важно учитывать как дозы, так и активность таких соединений по сравнению с эстрогеном. В этом обзоре сравнительный подход, включающий как дозировку, так и активность, используется для оценки того, может ли воздействие парабенов в утробе матери или во взрослом возрасте быть связано с побочными эффектами, опосредованными эстроген-модулирующим механизмом действия.

Ключевые слова: парабены, *p*-гидроксibenзоаты, ПОБК, применение парабенов, метилпарабен.

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