

# **DEODORANT TALC FOR LONG LASTING FRESHNESS**

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Skin one would agree is no ordinary structure in the human body. It acts as a protective cover for the body minimising loss of water from the body tissues and regulating body temperature. Various sensory nerve endings present on our skin helps to protect the human body from potentially damaging stimuli in the environment. Thus, skin behaves as a barrier separating the vulnerable interior of the human body from the vagaries of environment. The various cell types the skin contains may also develop its own degenerative disorders causing minor deviations damaging normal skin. Skin is frequently damaged because it cloaks the body and is right in the firing line of the environment.

Sweat glands are distributed throughout most of the skin. There are about 3 million active sweat glands in the body. Sweating is very important physiologically as active secretion plays a vital role in keeping the body cool and regulating body temperature. Sweat has indoxyl, volatile fatty acids, hydroxy acids, ammonia, and other metabolic excretory products. Fresh perspiration is odourless. The bacterial activity in presence of these secretions contributes to the intensity and quality of odour. People today want to smell fresh free from unpleasant body odour. The use of Personal care and hygiene products has become an essential part of personal hygiene. Deodorant Talcum powder is one such product that is very popular through out the world.

The function of a body powder is not only to mask minor imperfections but also to make skin look smooth to touch. It hides unwanted shine caused mainly due to perspiration and other oily secretions or those caused due to the use of cosmetic formulations. Body powder or talcum powder acts as a carrier for perfumes, which produces a cooling sensation by its dissemination over a large surface area. Actives present in modern day body powder functions as a deodorant giving a feeling of freshness to the user. Talcum powder acceptable for use confirms to the basic requirement of a reasonable lasting property of adhering to the skin and is resistant to the mixed body secretions. Today's talcum powder is a mixture of several ingredients chosen for its inherent specific properties. A mixture of different ingredients is necessary in a talcum powder because a single substance does not possess various properties necessary for a product to be used as a talcum powder.

## **BASIC ATTRIBUTES REQUIRED FOR A DEODORANT TALCUM POWDER.**

**Covering Power:** - The ability to mask imperfections present on skin.

**Absorbency:** - The capacity to absorb perspiration and body secretions.

**Slip:** - The quality to spread evenly and impart a characteristic smooth feeling when applied on skin.

**Adhesiveness:** - The ability to cling on to the body / skin for a sufficient time.

**Bloom:** - The glow and the silky / velvety feeling imparted to the skin when talcum powder is applied to it.

**Deodorant capacity:** - The ability of the body powder to keep one feeling fresh without any unpleasant body odour.

A good covering power is a prerequisite for any talcum powder formulation. This is because when a talcum powder is applied on skin it should be capable to hide, defects as scars, blemishes, larger pores and unwanted shine of the skin caused by natural moisture or perspiration and oily secretion of human body. Titanium dioxide, zinc oxide, magnesium oxide, kaolin is usually used to enhance the covering power of talcum powder. Titanium Dioxide has considerably greater covering power compared to zinc oxide. Usually titanium oxide is used along with some zinc oxide, as when used alone, titanium oxide can sometimes cause blending problems with other components of a talcum powder.

Zinc oxide is used to increase the covering power of talcum powder, but its incorporation also imparts soothing properties being a mild astringent unlike titanium dioxide. Zinc oxide also has a slightly

better sun screen property and helps in reducing minor skin irritations. To formulate a talcum powder with a good covering power a combination of titanium dioxide and zinc oxide is used at levels of 15 to 25%.

The particle size of titanium dioxide and zinc oxide also plays a major role in the talcum powder formulation. The smaller the particle sizes, the better the spread on the skin, and thinner the spread, the greater their physicals cover. Reducing the particle size of titanium dioxide and zinc oxide increases the scattering of light which in turn increases the opacity of talcum powder and so the covering power. However, if the particle size is smaller than the wavelength of light, i.e., below 0.25  $\mu\text{m}$  there is a decrease in the opacity and subsequent decrease in covering power. Under similar conditions, the covering power of different pigments proportionally increases with their refractive index. Thus, it can be predicted that materials with higher refractive index have a better covering power.

Magnesium oxide and superior grades of kaolin having a good covering power are also sometimes used in combination with titanium dioxide and zinc oxide in a talcum powder formulation. The opacity of various ingredients is estimated either visually or measured photoelectrically. The covering power of different cosmetic raw materials measured under similar particle size and experimental conditions showed that the opacity of titanium dioxide is maximum followed by zinc oxide, talc, rice starch, magnesium stearate, chalk, zinc stearate, kaolin, etc. Although in controlled experimental conditions the above results were obtained in actual conditions, the opacity will depend largely on the water and grease absorbing capacity. It will also depend on the various skin types, the foundation cream used, and the occupation of the ultimate user.

The next important requirement of a body powder is its ability to absorb perspiration and the greasy sebaceous secretions to eliminate the unwanted oily shine on the skin. The body powder should have a high absorbing power, not only for water but also for grease. The absorbing capacity of a talcum powder can be increased by use of colloidal kaolin, starches, precipitated chalk, magnesium carbonate, etc. If the user's skin is dry then a greasy foundation is usually used to counter the dry skin type. A talcum powder when used on such skin type will show unwanted oily shine if the powder used is not grease absorbent. Higher the opacity of the ingredient used the greater its ability to mask greasy skin.

Colloidal kaolin has very good water absorbing capacity and is used in talcum powder primarily for this purpose. Chemically kaolin is hydrated aluminium silicate. Nevertheless, ordinary china clay or any type of hydrated aluminium silicate cannot be classified as kaolin. Superior pharmaceutical grades of kaolin that are light in colour, free from grit and impurities like mica, quartz, feldspar, electronically purified are used in talcum powder preparation. Osmokaolin is one such grade preferred for use in talcum powder. Kaolin has a good absorbing power and its ability to reduce shine of talc used in the formulation makes it a good ingredient for use in a powder formulation. Kaolin's good covering power and its adhesion to skin also proves useful in talcum powders. The relatively higher density of kaolin when compared to other components in a talcum powder helps in controlling the bulk density. Incorporated upto 30% level in formulation kaolin however lacks slip and this aspect is to be considered while formulating a talcum powder. Super fine synthetic silicate can also be considered for use to improve oil and water absorbing properties of a talcum powder.

Special grades of starch are sometimes used as a base for talcum powder. Starch has very good absorptive properties and covering power imparting smoothness to the skin. Unfortunately, starch has a tendency to swell and form cakes in presence of excessive perspiration. The sticky paste so formed clogs the opening of the hair follicles present on the surface of the skin. Starches being ideal nutrients may sometimes favour bacterial growth. Starch nowadays is very rarely used albeit in minor amounts to impart some degree of bloom to the skin.

Superior grades of precipitated calcium carbonate having a very fine particle size, possessing good absorbing capacity and grease resisting properties are sometimes used to remove unnecessary shine imparted by talc. Precipitated calcium carbonate or chalk however affects the slip of the powder and gives a dry feel to the skin. Pharmaceutical quality magnesium carbonate at 5% level is used in talcum powder to effectively increase the absorbency and fluffiness of body talc. The presence of magnesium carbonate also helps in maturing the fragrance used in a talcum powder.

Adhesiveness or the ability of talcum powder to cling on to the body / skin for a sufficiently long time is imparted by the incorporation of stearic acid metallic soaps of zinc and magnesium. Present at 3 to 10% level, stearic acid soaps makes the talcum powder soft and fluffy increasing adhesion and water repelling properties. Minor amounts of emollients like cetyl alcohol, steryl alcohol, glyceryl monostearate, Lanolin derivatives also improves adhesion. Mineral oil and petroleum jelly in combination with cetyl alcohol produce a light and fluffy talcum powder with good adhesion. Addition of finely powdered pure silica in a talcum powder formulation also increases the fluffiness of the product by behaving as an anti-caking agent.

Slip or the smoothness feeling caused by uniform and even spreading in a talcum powder is imparted by use of magnesium stearate, zinc stearate and talc. Chemically talc or talcum is a naturally occurring mineral, hydrated magnesium silicate;  $[\text{Mg}_6\text{Si}_8\text{O}_{20}(\text{OH})_4]$  is the major component as the name suggests in body talcum powder. Structurally talc is a layer-lattice mineral, composed of a brucite sheet  $\text{Mg}_6(\text{OH})_{12}$  sandwiched between sheets of silica. The electrically neutral layers are held together by weak Van der Waals forces that are responsible for the ease with which talc can be cleaved to produce foliated particles of high surface area and the slip obtained between the layers when a shearing force is applied. Body powders commonly contain over 75% of talc. "Cosmetic grade talc" is prepared by milling from selected mines that supply talc of very high quality and purity and is very different to industrial minerals available as ordinary talc in terms of its impurities present. Pure talc is white in colour with a slippery feel and good powers of oil absorption. It is inert to most chemical reagents and is very soft in nature having only a hardness of 1 on the Moh's hardness scale. The refractive index of cosmetic talc ranges between 1.54 to 1.60 with a corresponding density of 2.75 to 2.80. Talc is stable to heat upto 900°C above which it loses chemically combined water. When talc is dispersed in water, it has an alkaline pH of 9 to 9.5. It is to be ensured that talc used in talcum powder should have a smooth feel with the talc particles passing through standard 200 mesh sieve and is not gritty. Talc acts as a carrier for perfume and actives in a deodorant talcum powder, giving a smooth feel to the skin, producing a cooling sensation due to its spread over a large surface area. Perfume stability and its final impact in a talcum powder mainly depend on the pH of talc used, the surface area, and the heavy metal impurities present in it. Impurities of hard minerals like silica and carbonate adversely affect the smoothness of talc and so have to be eliminated. The main function of talc is to impart slip and adhesion in a body powder. Talc has low covering power and moisture absorbing capacity that is addressed to by combining talc with other ingredients to formulate a superior talcum powder.

Talc deposits were formed in the crust of the earth by changes caused on certain rocks under the influence of environmental heat, atmosphere, pressure, and water. Thus, talc often contains other minerals such as quartz, chlorite, dolomite, magnesite, calcite, specks of mica and ultrabasic silicates having a chain silicate structure like amphiboles that include termolite, anthophyllite, actinolite, etc. Strictly speaking, these impurities cannot be called contaminants since they were present in the mineral and not added or introduced later while milling or transport. However, these accessory minerals are referred to as impurities as their presence is potentially harmful when present in talc for use in a body talcum powder. Tremolite, the most common amphibole contaminant, occurs rarely as the fibrous form, and commonly comprises as thick fibers or cleavage fragments that are not as hazardous as asbestos. However, if amphiboles are detected by X-ray diffraction in a talc deposit, it is considered unacceptable for cosmetic use. Chrysolite that belongs to the same class of impurities as asbestos, is a sheet silicate and should be absent in talc for it being considered as cosmetic talc grade.

Quartz contamination even in trace amounts could give gritty talc that would be technically unacceptable. Chlorites are structurally similar to talc having similar properties. However, substitution of some Magnesium ions in the crystal lattice by aluminium and/or iron results in undesirable green colours not suitable for talcum powder. Carbonates such as dolomites, calcite, magnesite, and phosphates like apatites are other major contaminants in talc and due to the lack of a platy structure, they reduce the quality of talc if present. Their presence can also affect the perfume integrity due to their potential reactivity with perfumery ingredients. Naturally occurring rutile titanium dioxide is often present in the crystal lattice of Magneite or iron oxide that are dark coloured and gritty and are undesirable in talc for cosmetic use.

The different mineral ingredients, used in a talcum powder may vary in microbial population. The source of contamination may be through direct faecal residues from animal sources and soil or indirectly

from contaminated water. For general use in cosmetic's treatment is essential for reducing the total microbial population to levels approved by the regulatory authorities. Treatment may be carried out either by dry heat, steam, ethylene oxide and gamma irradiation. The efficacy of the procedures should be monitored routinely. Treatment with ethylene oxide may result in residues of the gas or its by-products that have to be effectively controlled.

Triclosan, (Irgasan® DP 300) is a synthetic chemical that has been extensively used for more than two decades. Chemically it is 2,4,4' trichloro-2' hydroxy diphenyl ether, an odourless or very faintly aromatic, off-white powder, with a melting point of  $57^{\circ}\pm 1^{\circ}\text{C}$ . This non ionic antibacterial agent is now being used by almost all major Personal hygiene product manufacturers, at 0.2% to 0.3% (w/w) of the formulation to effectively reduce body odour. Triclosan is an effective against both gram-positive and gram-negative organisms when formulated in personal care products like skincreams, soaps, deodorants, or talcum powder. It is stable in normal storage conditions, easy to incorporate in a talcum powder formulation. Thermal stability studies have proved that Triclosan is relatively stable up to  $150^{\circ}\text{C}$  and upto  $200^{\circ}\text{C}$ , if not heated continuously for more than 2 hours. It is practically insoluble in water, moderately soluble in alkaline solutions, and readily soluble in most non-polar organic solvents. Triclosan is lipid soluble, antibacterial substance incorporated at a level of 0.2% to 0.3% (w/w) of the formulation, dissolved in suitable solvents and added to personal care products like skincreams, soaps, deodorants, talcum powder, etc., to inhibit halitosis. It would help in not only improving but also maintaining the high standard of personal hygiene necessary for complete body care.

Triclosan is a broad-spectrum antimicrobial agent whose activity is dependent on, the concentration and formulation of the product. Different experiments and extensive studies carried out to find the mode of action of Triclosan concluded that the primary action of Triclosan is directed against RNA, and protein synthesis in bacteria, and not against DNA synthesis. It is considered that the uptake of nutrient molecules by the bacterial cell wall as well as whole bacterial cells by diffusion might be inhibited by Triclosan with the cytoplasmic membrane being the target. When exposed to low concentrations of Triclosan, the bacterial cells do not die, but their growth and multiplication are inhibited although the degree may not be the same for all nutrient molecules. Experimental findings support the hypothesis that bactericidal concentrations of Triclosan induce a release of cytoplasmic material from the bacterial cells, inducing a decrease in the optical density of the suspension and eventual death. Thus there is a difference between the bacteriostatic effect of Triclosan that results due to the prevention of the uptake of nutrients by the cell membrane and the bactericidal effect that is caused due to the irreversible disruption and rupture of the cell membrane.

Acute toxicity studies reveal that Triclosan is not a toxicant. The subacute and subchronic toxicity profile has also been well documented. Studies conducted by the pathology-working group, showed no evidence of carcinogenic potential at any level. Studies conducted to judge the mutagenicity of Triclosan showed negative results. In a two-generation reproduction study, there were no adverse effects on the reproduction performance at any dose tested. In studies conducted to assess the development toxicity, Triclosan was found to have no potential for teratologic effect. It is not skin sensitising and does not have photosensitising effect. Human safety studies conducted to determine the safety of Triclosan showed no adverse effects. Blood chemistry and haematological measurements conducted during these studies showed no difference between control subjects and one is using Triclosan.

**An example of a Deodorant talcum powder: -**

0.2%	Triclosan
75%	Talcum
10%	Kaolin
2.0%	Fumed Silica
6.0%	Magnesium Carbonate
6.0%	Zinc Stearate
0.8%	Fragrance

Triclosan containing talcum powders show an antibacterial effect against pathogenic gram-positive and gram-negative strains that are involved in numerous infection and diseases. Triclosan, antibacterial activity against Corynebacteria and Micrococcus luteus, which are mainly responsible for

unpleasant body odour has been determined by well-designed sniff test studies. Similarly, its effect against *Trichophyton mentagrophytes*, the main strain in causing the disease athlete's foot, has been proven. Triclosan containing talcum powders can reduce body malodour and have a prophylactic activity against athletes' foot in controlling foot malodour.

Triclosan for use in personal hygiene products should not only be analysed for its quantitative purity but also for the presence of impurities. This is especially important for polychlorinated dioxins and Furans such as the 2,3,7,8, Isomers commonly known as Dioxins - dioxins, which are unwanted by-products during Triclosan manufacture. Dioxins as are highly toxic, persistent substances, with a wide range of adverse effects. Dioxins can produce a plethora of responses in animals and presumably in humans, which can lead to chloracne, carcinogenicity, reproductive and developmental effects, immunotoxicity, effects on circulating reproductive hormones, increased risk of diabetes, endometriosis and enzyme induction's. It is very important that only superior and approved quality Triclosan is used in personal hygiene products.

Perfume oils are easily incorporated in body powder. Perfumes used should be sufficiently powerful to cover the base odour without interfering with the actives that may be used. Perfumes must be pleasant and long lasting. Lemony and flowery fragrances are usually preferred. Selection of a particular perfume for talcum powder and the compatibility of the perfume with different ingredients must be checked by carrying out the necessary acceptance tests required.

Colorants are very rarely used in talcum powders and if used then in very small proportion. Organic or Inorganic pigments are preferred. Oil soluble and water-soluble colours are avoided because of possible bleeding due to dissolution of the colorants, by perspiration and lipid secretions. However it should be emphasised that only non-toxic colorants giving no indications of adverse effects like irritation, skin sensitisation or subacute toxicity, allergy, carcinogenic, mutagenic or teratogenic effects and that is environmentally acceptable be used and all colorants used should comply with the relevant specifications laid down by BIS, and permitted to be used by, The Drugs and Cosmetics Rules, framed by the Government of India. Toxic metal impurities of Arsenic, Heavy metals, Cobalt, Chromium, Nickel that may be present in inferior quality colorants in substantial proportion could cause responses in humans in form of Allergic Contact Dermatitis. This condition of Allergic Dermatitis is chronic in nature and its symptoms remain even after the obvious source of contamination is removed. Good manufacturing practice is to be followed with utmost importance during manufacture to limit these impurities within acceptable limits as it is suspected that even low level of these toxic impurities is sufficient to maintain Allergic Dermatitis. This naturally infers that colorants used should be of a good quality free from toxic metal impurities to reduce hazard to the user.

Manufacturing talcum powder involves mixing of various ingredients selected in a horizontal mixture with a screw agitator. Micropulverisers, disintegrators, hammer mills, etc., and machines that mix, sieve and spray perfume automatically are available, and are being increasingly used for manufacturing. When mixing colorants and actives it is preferable that a small quantity of the colour is mixed with one of the various mineral ingredients to get a concentrate that is then mixed with the main bulk of the powder to get a uniform mass.

Talcum powder is perfectly safe as a cosmetic in our daily use. However in the manufacturing site its presence as an airborne particulate, if uncontrolled can be a health hazard to workers who are exposed every day. Vacuum cleaners with filters capable of retaining fine particles and well-designed air extraction equipment's, is to be fitted to avoid unwanted high concentrations of airborne dust in the workplace. The workers should be enforced to use suitable respiratory protective equipment's viz., filter masks, dust lamps, etc., at the manufacturing site. Talc exposure levels at the workplace must be monitored and adhered to the limits laid down by the regulatory authorities. Reassessment and regular monitoring exercise, are to be carried out to detect any changes in concentration levels in the atmosphere, resulting from wear and tear of the machinery, plant defects and changes in operator working habits. Packaging of talcum powder is best carried out by use of vacuum filling devices to reduce dusting and extraneous contamination in container's compatible with the different ingredients.

The growing awareness, improvements in the living standard and sophistication of society, has changed the set standards of Personal Hygiene. Today's social circle accepts people who smell excitingly fresh, without unpleasant body odour and deodorant body talc helps fulfil this necessity like never before.