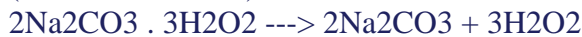


## OXYGEN BLEACHING AGENT FOR DETERGENT

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### 1. What is sodium percarbonate?

**Sodium percarbonate** (or sodium carbonate peroxyhydrate) is an addition compound of sodium carbonate and hydrogen peroxide. When dissolved into water, it releases H<sub>2</sub>O<sub>2</sub> and soda ash (sodium carbonate).



The pH of the resulting solution is typically alkaline, which activates the H<sub>2</sub>O<sub>2</sub> for bleaching. The dry powder contains about 30% w/w H<sub>2</sub>O<sub>2</sub>.

### 2. What are the applications of sodium percarbonate?

**Sodium percarbonate** has a wide range of applications in various solid detergent products and all fabric bleaches. We may also find its usages in oxygen release compositions, personal care formulations, disinfectants, food bleaches, pulp and paper bleaches and textile bleaches, etc.

### 3. What are the advantages of sodium percarbonate?

Compared with chlorine bleaching chemicals that have contaminations on the environment, **sodium percarbonate** is an environmentally friendly chemical which decomposes into oxygen, water and natural soda ash when in contact with hydrous media.

Sodium percarbonate is increasingly being the substitute for sodium perborate in detergent formulations due to its lower dissolving temperature in water, as well as the characteristic of no contamination on soil, as sodium perborate is made of borax which is found to have negative impact on the soil quality.

Detergent or bleach compositions formulated with sodium percarbonate have a strong stain removal capability. It is very effective as a laundry presoak for heavily stained articles. It is color safe. It brightens colors and prevents fabric from becoming yellowed or darkened.

Sodium percarbonate is effective as a disinfectant on both bacteria and virus. It's an excellent ingredient in personal care and home care formulations for hygiene.

For its environmental advantages, sodium percarbonate is a good oxygen release chemical for agricultural and aquicultural applications.

### 5. What's the difference between the coated and uncoated sodium percarbonate?

**Sodium percarbonate** is used as an active oxygen component in detergents, bleaches and cleaning agents. Due to the unsatisfactory storage stability of the uncoated sodium percarbonate in warm/moist surroundings and in the presence of certain detergent and cleaning agent components, sodium percarbonate must be stabilized against the loss of active oxygen. An essential principle of stabilization involves encasing the sodium percarbonate particles in a coating of components having a stabilizing action. Here comes the definition: the coated sodium percarbonate is the sodium percarbonate crystals coated with single or multiple layers of various substances in order to increase active oxygen stability and optimize storage and ensiling properties.

Coated **sodium percarbonate** is the more commonly commercialized peroxide compared with the uncoated sodium percarbonate. But the uncoated product is still the preferred ingredient for simply mixing with enough quantity of soda ash and some surfactants to form the popular oxygen bleaches.

## **6. How to make PCS based oxygen bleach system stable in powder detergent formulations?**

Detergent compositions containing **sodium percarbonate** are known in the art. Sodium percarbonate is an attractive perhydrate for use in detergent compositions because it dissolves readily in water, is weight efficient and, after giving up its available oxygen, provides a useful source of carbonate ions for detergency purposes.

However, the inclusion of percarbonate salts in detergent compositions has been restricted by the relative instability of the bleach both as is and in use. Sodium percarbonate loses its available oxygen at a significant rate in the presence of ions of heavy metals such as iron, copper and manganese and also in the presence of moisture, these effects being accelerated at temperatures in excess of about 30.degree. C. To solve this problem, several solutions have been found.

- 1, Sodium percarbonate is coated with a hydrophobic substance or the like.
- 2, Magnesium silicate is incorporated in a detergent composition containing sodium percarbonate.
- 3, A chelating agent which forms an easily water-soluble metal chelated compound such as nitrilotriacetate (NTA) or ethylene diamine tetraacetate (EDTA) is incorporated in a detergent composition.
- 4, Zeolite A is replaced by maximum aluminium zeolite P (zeolite MAP) since zeolite MAP itself is of greater liquid carrying capacity than zeolite A.
- 5, The elimination of impurities, such as heavy metals which catalyze the decomposition reaction during detergent processing, alleviates the instability of aqueous SCP solutions.
- 6, Provide sufficient sodium carbonate in the composition to be able to combine with all of the available water in the composition to form sodium carbonate monohydrate. the term "available water" includes water chemically available as hydrogen peroxide, water of crystallization of sodium carbonate hydrates and free water which may temporarily exist in the composition.

**7. What's the amount of sodium percarbonate to be formulated in bleach and detergent compositions?**

Oxygen Bleach Type	Ingredients	% By WT.
Home Laundry Bleach Premium Grade	Sodium Percarbonate	25.0
	Soda Ash	50.0
	Nonionic Surfactant	3.0
	Sodium Sulfate	22.0
	Total	100.0
Home Laundry Bleach Economy Grade	Sodium Percarbonate	25.0
	Soda Ash	75.0
	Total	100.0
Home Laundry Bleach Concentrated Grade	Sodium Percarbonate	80.0
	Soda Ash	20.0
	Total	100.0
Institutional Laundry Bleach	Sodium Percarbonate	80.0
	Soda Ash	20.0
	Total	100.0
Concrete Cleaner	Sodium Percarbonate	78.0
	Soda Ash	20.0
	Nonionic Surfactant	2.0
	Total	100.0
Vinyl Siding Cleaner	Sodium Percarbonate	28.0
	Soda Ash	72.0
	Total	100.0
Wood Deck Cleaner and Stain Remover	Sodium Percarbonate	80.0
	Soda Ash	10.0
	Sodium Tripolyphosphate	10.0
	Total	100.0
Marine Teak Cleaner	Sodium Percarbonate	58.0
	Soda Ash	40.0
	Nonionic Surfactant	2.0
	Total	100.0

Powder dertergents	Ingredients	% By WT.
Standard detergent base PCS(8~15%, by WT.)	Sodium Percarbonate	12.5
	Soda Ash	16.4
	Nonionic Surfactant	4.1
	Linear alkylbenzene sulphonate	9.0
	Zeolite MAP (as anhydrous)	37.7
	Acrylic/maleic copolymer	4.0
	Sodium alkaline silicate	0.6
	SCMC	0.8
	Fluorescer	0.3
	Soap	2.5
	Moisture (nominal)	12.2

## 8. What is sodium perborate?

**Sodium perborate** usually exists in two forms, tetrahydrated and monohydrated. Sodium perborate tetrahydrate is obtained by addition of hydrogen peroxide to a sodium metaborate solution at a temperature close to 20.degree. C. Sodium perborate monohydrate is produced by dehydrating sodium perborate tetrahydrate in a fluid bed with heated air. Sodium perborate releases nascent oxygen at elevated temperatures, and so acts as a hydrogen peroxide bleach.

The monohydrated form is essentially showing three advantages in comparison with the tetrahydrated form: a higher content of available oxygen, a higher heat stability and a higher dissolution rate into water. **Sodium perborate** has been in detergent and personal care formulations for many years. Its oxidative power improves the cleaning, bleaching, stain removal and deodorizing performance of powder detergent formulations, all fabric dry bleaches, denture cleaners, automatic dishwasher detergents and various institutional and industrial laundry products. It's main disadvantage is that the bleaching action only takes place at elevated temperatures. To release it's bleaching action at lower temperatures, an activator must be added.

## 9. What are the differences between sodium perborate and sodium percarbonate?

Both **sodium perborate** and sodium percarbonate are oxygen release bleaching chemicals that are widely applied in various bleach compositions. It is known that sodium perborate as the bleaching agent has a high bleaching effect at high temperatures but the effect is lowered at low temperatures. On the other hand, sodium percarbonate has an effective bleaching action even at low temperatures and is very valuable from the viewpoint of saving of energy. Sodium percarbonate is an attractive perhydrate for use in detergent compositions because it dissolves readily in water, is weight efficient and, after giving up its available oxygen, provides a useful source of carbonate ions for detergency purposes. **Sodium perborate** has a better stability and has been a mature bleaching ingredients for long time. But it is increasingly replaced by sodium percarbonate duo to its disadvantages in energy saving and environment protection. Sodium percarbonate exhibits an excellent bleaching effect even at a low temperature and is environmentally friendly, but it is less stable in detergent formulations. However, many processes have been found to improve its stability.

## 10. Sodium perborate in detergent and bleach formulations.

Conventional detergent powders (Sodium Perborate Monohydrate, 8%~15%)

Ingredients	% By WT.
Sodium Perborate Monohydrate	10
TAED	2.5
Zeolite	28
Sodium Carbonate	20
Sodium Silicate	4
PCAs	4
Surfactants	15
Enzymes	0.5
Optical Brightners	0.3
Sodium Sulfate	9
Perfume	0.2
Antiredecomposition Agents	1

Moistures	5
Total	100

Compact detergent powders (Sodium Perborate Monohydrate, 10%~20%)

Ingredients	% By WT.
Sodium Perborate Monohydrate	15
TAED	5
Zeolite	24.5
Sodium Carbonate	20
Sodium Silicate	4
PCAs	4
Surfactants	15
Enzymes	0.5
Optical Brightners	0.3
Sodium Sulfate	5
Perfume	0.2
Antiredecomposition Agents	1
Moistures	5
Total	100

Oxygen Bleach Powder (Sodium Perborate Monohydrate, 30%~80%)

Ingredients	% By WT.
Sodium Perborate Monohydrate	45
TAED	15
Sodium Carbonate	40
Total	100

### 11. Sodium perborate monohydrate incorporated in tooth bleach compositions.

Since its introduction in early 1989, there has been significant interest among the dental profession and the general public for home-use tooth bleaching products and methods. Typical dental bleaching compositions include from 5-20% by weight of carbamide peroxide (CO(NH.sub.2).sub.2.H.sub.2 O.sub.2), which is a complex of urea and hydrogen peroxide.

However, **sodium perborate** has been found to be another dental bleaching agent. An advantage of perborate-based bleaching agents rather than aqueous hydrogen peroxide or carbamide peroxide is that perborates are allowed for dental bleaching procedures in some countries that do not permit the use of aqueous hydrogen peroxide and carbamide peroxide for dental bleaching. Perhaps perborate compounds are more gentle on surrounding gums and tissues compared to either aqueous hydrogen peroxide or carbamide peroxide. Nevertheless, perborates were found to be unstable when blended with carboxypolymethylene, which is the tackifying agent of choice in the vast majority of home bleaching kits presently on the market. For this reason, a tackifying agent that is stable in the presence of perborate bleaching agents has been developed, which comprises a mixture of a suitable polyol and a finely divided gel-forming particulate such as fumed silica, otherwise known as silica fume.

Below is a sample dental bleaching composition that combines the following ingredients (in weight percent):

Anhydrous Propylene Glycol 54.3%  
 Fumed Silica 20%  
 Sodium Perborate Monohydrate 25%

Sodium Saccharine 0.7%