**Action of Peroxide cleaners for restoration of Vinyl My Little Pony Toys manufactured in the 1980s and early 1990s- Written by Aimee Trail (BApAnTech), February 2019.**

Brief:
There has been considerable discussion around the use of peroxide as cleaning and bleaching agents on vinyl My Little Pony (MLP) toys. This article has been written to outline the chemical differences between the two commonly used forms of chemical, Hydrogen Peroxide and Benzoyl Peroxide. Its intent is to present the science-based facts around chemical make up, action and the reactions of the two peroxide forms, allowing restorers and owners to make an informed decision when considering using these products on the pony toys.

Table 1: Chemical Structure comparison (Images from Wikipedia)

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| --- | --- | --- |
|  | Benzoyl Peroxide | Hydrogen Peroxide |
| Basic Structure | Benzoyl-peroxide.svg | Structural formula of hydrogen peroxide |
| Atomic structure | Benzoyl-peroxide-3D-balls.png | Related image |
| Chemical Formula | (C6H5CO)2O2 | H2O2 |
| By products | C6H5C(O)O-OC(O)C6H5 + H2O http://www.chm.bris.ac.uk/motm/benzoyl-peroxide/arrow.gif2 C6H5COOH + ½ O2(Benzoic Acid + Oxygen) | H2O +O(Water + Oxygen) |
| Reactivity | Weak bonds - highly reactive | [Thermodynamically](https://en.wikipedia.org/wiki/Thermodynamic) unstable |
| Properties | Not water-soluble, forms a film | Rapidly decomposes to form water and oxygen |
| Typical Uses | BactericideBleaching agent for flour, hair, teeth, textiles.Industrial Plastics | OxidiserBleaching AgentAntiseptic |
|  | A powerful [bleaching agent](https://en.wikipedia.org/wiki/Bleach). Contact with [fabrics](https://en.wikipedia.org/wiki/Fabric) or [hair](https://en.wikipedia.org/wiki/Hair) can cause permanent colour dampening almost immediately. Even secondary contact can cause bleaching.  | A strong ox­i­diz­er which en­ters into re­ac­tions with many sub­stances: hy­dro­gen per­ox­ide eas­i­ly breaks down into oxy­gen and wa­ter when ex­posed to light. |

**Use of peroxide on vinyl pony toys.**

The word peroxide simply means, a compound containing two oxygen atoms bonded together within its molecule. For example, the oxygen that we breathe arrives in our system as a peroxide molecule. Oxygen has an unstable outer electron field and often creates a shared electron bond of O22−. There are many different compounds that contain Peroxides as a part of their chemical makeup. In this article we are looking specifically at the compounds Benzoyl Peroxide and Hydrogen Peroxide.

Benzoyl Peroxide is a very reactive compound. It has weak Oxygen to Oxygen molecular bonds which split apart very easily. Benzoyl peroxide is fast acting, reacting with the surface it is applied to almost immediately in many cases. It is typically sold in a concentration of 2.5% to 10% usually in the form of a cream or gel to be applied to skin. Its high antibacterial activity makes it useful for reducing and treating acne and pimples. When applied the Benzoyl Peroxide breaks down into two components, Oxygen and Benzoic acid. Benzoic acid is not a particularly harmful compound and is used widely as a food preservative. (Ref. 1)

Hydrogen Peroxide is also very reactive and rapidly breaks down into two relatively harmless components, Water and Oxygen. Once this reaction is complete the bleaching action of the compound is neutralised. It is sold in multiple forms, most restorers will be familiar with it in its purest form as a diluted liquid (for Sun Fading), in a Laundry Soaker chemical form (for Oxi Bathing), As a whitening agent in toothpaste (For removing rust from pony hair) and as a stabilised cream (Hair Developer). A stabilised cream will contain additional ingredients to slow down the reaction time of the Active ingredients to produce an even bleaching result (such as when applied to human hair and the application time is spread). Because Hydrogen Peroxide is Thermodynamically unstable it is usually used in conjunction with Heat and/or light (UV) to speed up the reaction time. When the pony toy is treated with Hydrogen Peroxide and put out to “Sun Fade” the UV from the sun acts as a catalyst and causes the Hydrogen Peroxide to decompose faster. Similarly, when using an “Oxi Action” laundry product to soak ponies in warm or hot water is used which also speeds up the reaction time.

The major difference between the two compounds is that Benzoyl Peroxide is NOT water soluble. (Ref. 2) This means that when it is applied to a surface, be it human skin or teeth or the vinyl of a pony, it creates a long-lasting film at the surface. While this is useful for producing a long acting effect on skin and teeth, on vinyl it also produces a long acting bleaching effect that is not rinsed away or ceased with regular washing in water. It requires the use of an Alkaline compound, such as Sodium Hydroxide (Caustic soda), to neutralise its action on that surface. Potentially this film can also be transferred to other objects that come in contact with the treated area, causing a bleaching effect on the secondary item.

So, to summarise, in relation to use in cleaning procedures on My Little Pony Toys, many users may not have even realised they were already using a Peroxide product as an everyday cleaning or restoration product. The two compounds, Benzoyl Peroxide and Hydrogen Peroxide, have very different chemical components resulting in markedly different attributes. Benzoyl Peroxide produces a fast, long acting treatment that does not require additional variables such as heat or UV light to activate and cannot be neutralised without an appropriate chemical neutraliser. Hydrogen peroxide produces a slower reaction which can be speed up with an appropriate catalyst and rapidly decomposes into neutral components. Ultimately it falls upon the user to make decisions as to the products they choose to use as part of their restoration process, but hopefully this article has provided some useful insights as to how these products work and the differences between them.

**Reference 1: Benzoyl Peroxide (and other chemicals used for the treatment of acne) Article by:** **Simon Cotton****,** [**University of Birmingham**](http://www.birmingham.ac.uk/schools/chemistry/index.aspx)**, February 2017**

**Source:** http://www.chm.bris.ac.uk/motm/benzoyl-peroxide/benzoylh.htm

**Reference 2: Difference Between Hydrogen Peroxide & Benzoyl Peroxide Article By: Vincent Summers; Updated April 24, 2017**

**Source:** <https://sciencing.com/difference-hydrogen-peroxide-benzoyl-peroxide-6184362.html?fbclid=IwAR33SGDh9CeMvMdrxREUBzKNtaUMy2rOUOrNfmzR_nbKx-8w4euA_pNsBBQ>