

## OLEORESIN CAPSICUM AND PEPPER SPRAYS

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Pepper sprays have been in use since about 1977 in the United States.<sup>1</sup> During this time, virtually all of the products produced contain natural **Oleoresin Capsicum** as the active ingredient. Oleoresin Capsicum (OC) is obtained through an extraction process from chili peppers. Selected peppers are dried and ground into a fine powder. The oleoresin in the powder is generally extracted with the addition of an organic solvent. This mixture of powder and solvent is referred to as Miscella. Once the oleoresin extraction is complete, the solvent in the solution is removed via evaporation or distillation. When the solvent is removed from the Miscella, the remaining oily substance is raw Oleoresin capsicum, the strength of which is dependent upon the grade of the peppers that were utilized. In addition, the raw OC is diluted to various strengths according to customer specifications. Depending upon the applications, the raw OC can be mixed with a mineral, vegetable, or soy oil. If the product is to be water soluble, the OC is mixed with Propylene Glycol or Polysorbate (TWEEN 80). These are emulsifiers, and are used to hold the OC in suspension. However, no matter how much dilution takes place, the product is considered Oleoresin Capsicum and labeled as such, but obviously not all of the same strength or intensity.

These OC solutions are produced for the food and pharmaceutical industry as well as for use in pepper sprays. The OC is used in salsas and hot sauces to increase the heat level. The pharmaceutical applications are as analgesics in heat creams and rubs. Products containing Capsaicin are also used in topical cremes for relief from arthritis and certain skin diseases. The Oleoresin Capsicum consists of three major components that cause the pungency or hotness. These components are known as capsaicinoids, with the three major being: Capsaicin, Dihydrocapsaicin, and Nordihydrocapsaicin. The capsaicinoid content in a given solution is the determining factor of how hot a product will be.<sup>2</sup> For example, the higher the capsaicinoid concentration, the hotter the product, and vice versa.

In pepper sprays, the OC is combined with other products that hold the OC in solution and a propellant to discharge the solution. The area of concern in pepper sprays is to find the level that causes the desired effect, without risking permanent damage. It has been reported that increased levels of capsaicin can cause nerve damage, and possibly death of pain fibers.<sup>3</sup> The analogy of a match and a blow torch are often used. A match has the ability to cause pain and burning when placed close to the skin. The blow torch acts in much the same way; however, the level of hotness is much greater and can cause permanent damage. A concern most often overlooked is determining what these other products are. This concern is valid, considering that the other ingredients make up the majority (90-95%) of the product mixture. Often time, these mixtures are flammable, or contain ingredients that are listed as poisons, toxic, or cancer-causing.

Current manufacturing claims promote products based on **Scoville Heat Units (SHU's)**, **percentages of Oleoresin Capsicum (% OC)**, and **Capsaicinoid Concentration**. These terms are useful, when properly understood and used in the right context. However, when used incorrectly, their claims range from misleading to erroneous. Following is a description of each:

**Scoville Heat Units (SHU's)** is a measurement of heat, as perceived from a burn sensation when a product is placed on the tongue. This measurement is based on a scoring system assigned by a panel of five tasters. This procedure is described in the American Spice Trade Association, Analytical Methods 21.0. As with any subjective test, by definition, it is based on the perception of heat, rather than an independent measure of heat. What one panel may assign as a rating, could vary when measured by another panel.

**Percentage of Oleoresin Capsicum** is a measurement of the amount of Oleoresin Capsicum contained in a given solution. While this seems easy enough, it is probably the most misleading. This is due to the wide interpretation of Oleoresin Capsicum. More specifically, the composition and pungency of OC vary from manufacturer to manufacturer. As mentioned above, OC is produced in various grades of qualities and extraction processes. For example, higher quality peppers yield a hotter product, while lower quality peppers are not as hot. In addition to this variance, once the OC is obtained in the extraction process, it is considered a raw product and labeled as Oleoresin Capsicum. At that point, the manufacturer adds various other products to it. This is done for a variety of reasons, to reduce the hotness or to make it a water soluble product. However, each end product is considered Oleoresin Capsicum, but can be very different solutions. Therefore, it is possible for a lower concentration solution of OC to be more pungent than a high OC concentration solution, depending on the quality of peppers used. For this reason, % OC is not a reliable indicator of product pungency or intensity. This leads us into the final measurement property.

**Capsaicinoid Concentration** is the determination of active components in Oleoresin Capsicum. Capsaicinoids are the group of compounds that cause the burning sensation. There are the three main compounds that make up about 95% of the Capsaicinoids: Capsaicin, Dihydrocapsaicin, and Nordihydrocapsaicin. The Capsaicinoid Concentration is the amount of these compounds in a certain solution. Therefore, by measuring the amount of capsaicinoids, an accurate level of pungency can be determined for the solution. This is the unit of measurement that is the most consistent and best representation throughout all grades of Oleoresin Capsicum. In essence, it is the equaling factor between SHU's and % OC.

While the strength of the selected peppers may vary from year to year or between seasons, the measurement of capsaicinoids is consistent in determining that hotness. A 0.2% Capsaicinoid Concentration will yield the same amount of hotness, regardless of the batch of peppers or their location of cultivation. For this reason, it is the only accurate method of determining the pungency of peppers. The current detection method for this analysis is by High-Performance Liquid Chromatography, HPLC.<sup>4</sup> Therefore, by establishing quality control monitoring the capsaicinoid concentration, a consistent strength or pungency can be easily obtained and verified by this analysis.

There are numerous pepper spray products on the market in various formulations and sizes. Unfortunately, there are only a couple of states that regulate these products or require product testing, although the number is increasing. The leader in testing requirements is the State of California, which requires pepper spray products to undergo independent laboratory testing, including content analysis. On the next page are ten products labeled only as A, B, C, ...etc. which have been analyzed by an independent laboratory, only one of which (J) is approved for sale to civilians in California.