

OxiScience Technologies: Competitive Advantages

Introduction: OxiScience LLC creates and develops innovative technologies for odor control and the surface integration of antimicrobial properties, for product applications in consumer, industrial, healthcare and agricultural categories. The company's Intellectual Property (IP) portfolio encompasses granted US patents 10,028,482, 10, 131,731, and US Application #15/872,617 (due to grant in November 2019), along with accumulated operational know-how (kept as trade secrets).

OxiScience Technology lays down unique polymer coatings on a wide range of surfaces, soft and hard, at manufacturing level, that confer unprecedented properties on household and industrial goods, useful for odor control and anti-germ functions. The coatings can be economically applied on single use disposable items, such as pet litter, carpet or shoe deodorizers. They can also be made durable/refreshable on products such as **apparel, where there is a need for malodor protection throughout the useful life of the article.** The active components can also be formulated as liquids for user applications in some cases (e.g., as unique disinfectants, deodorants).

The coatings can be made using chemical commodity components from the industrial marketplace; OxiScience proprietary formulations create new compositions of matter and methods of use. Odor-controlling mechanisms result from oxidizing power harnessed into the polymer coating layers. The pathways that lead to odor control are based upon classical chemistry principles, but prior to OxiScience's advances, it was impossible to deploy them in the commercially viable ways.

Competitive advantages:

Comparative evaluation of technologies aimed at odor control comes with a significant advantage: **users can tell if the products work or not.** Real-world testing of Oxi products provides quick feedback to inform performance improvements, and reveal competitive benefits of our technology. Conventional approaches to odor control are all based on:

- 1) Non-specific adsorption/absorption media (mostly granular activated carbon --GAC), e.g., sachets of GAC for confined space use such as in drawers, shoes, air filter media.
- 2) Incorporating antimicrobial chemicals into products to stop microbes proliferating in or on the surfaces, and releasing smelly metabolic products (for example, integrating silver particles into bath towels, socks, underwear.)
- 3) Integrating fragrances emitted into the surrounding air as a means of 'masking' foul odors. This is a commonly employed measure in many household disinfectants and deodorizers.

All these methods have serious limitations compared to Oxi proprietary systems.

- Absorptive media, like GAC have a defined 'sorptive' range and capacity, and when it is overcome there follows the inevitable onset of bacterial and mold growth right within the GAC itself. Absorbed organic compounds, even malodorants, become a table-laid food supply for micro-organisms to grow and make smelly products.
- Antimicrobial compounds economically available for convenient integration into or onto soft or hard surfaces at manufacturing scale, such as Quaternary compounds, triclosan,

PHMB, copper and **silver** ion releasers, all **are all slow-acting, have very limited fire-power, and a poor spectrum of action compared to Oxi coatings** (e.g., Purista, Microban, Silvadur). Some of them even cause antibiotic resistance to develop in microbes, and some are toxic, known carcinogens (e.g., PHMB). **Our Oxi coatings act super-fast, affect all classes of microbes and their enzymes, and directly degrade a wide range of malodorous compounds**

- Perfumes that are powerful enough to mask malodors are likely to cause their own annoyances as they permeate air space. Perfumes replace what is objectionable with smells that are marginally less offensive or annoying. Fragrance masking is a complicated area of science, not readily achieved with perfumes that are cheap enough to be incorporated into consumer or industrial products. Fragrance permeation of household air also tends to tell you that it is there in order to cover up something else.

There is a fourth area of odor control technology represented by the so-called ‘capture’ chemistry championed by P&G with their branded “Febreze” technology. An expensive but successful branding strategy has staked out a big market position for ‘encapsulation’ of odors products in the US. But the weakness of the chemistry has led to most Febreze product offerings being ‘fragrance dispensers’ now. Competing “capture and encapsulation” technology claims have been made around the industry (e.g., Ordenone), but without any serious evidence that they work as claimed.

OxiScience offers a unique, patented mode of action: OxiScience odor control chemistry works through the incorporation and display of active ‘oxidizing’ chlorine atoms in a unique, controlled way. We make this happen by selecting molecular carriers that hold on tight to the active oxidizing principles. We blend these with complementary compounds that provide for stickiness, stability and persistence of odor control on treated surfaces. There are no ‘masking’ fragrances so common in competing existing, ineffective odor control offerings. The resulting malodor control comes primarily from:

- 1) Complete degradation of objectionable, foul malodorants rapidly on contact with the OxiScience ‘actives’ This effect is proven, potent, reliable, and fundamental to satisfactory prevention and mitigation of odor control in all our applications
- 2) All OxiScience formulations and coatings have enough oxidizing power to kill bacteria, yeasts, fungus and other microbes. That is certainly one of the supplemental benefits. However, it is NOT the key to controlling odors in the short run. Of course, many microbes that can create malodors, so killing those off on surfaces or stopping them from growing in the first place can be a valuable longer-term odor-control benefit.
- 3) OxiScience coatings are inhibitors of many types of enzymes secreted by environmental microbes as they work on food sources, and generate foul-smelling products.

None of the competing technologies lay claim to direct degradation of malodors, or to the microbial enzymes that create odors. OxiScience formulations are not hazardous to handle, contain components that are fully biodegradable, and all are presently available in the stream of commerce in the US, for other purposes than odor control. No hazardous waste streams are generated.

In summary: OxiScience coatings: 1) provide short-run, very fast destruction of pre-formed odors; and 2) keep on top of ongoing formation of malodors by either killing microbes that grow and make bad smells; or 3) inhibiting the enzymes that those microbes use to make malodors. Liquid formulations take advantage of their persistence and stability to provide for long term control of odor and microbial protection of user-treated surfaces. There is nothing like this coating approach in the consumer, commercial or industrial categories. Moreover, OxiScience products are now proven in the marketplace, and highly valued for delivering on their promises.