

# Avenova® (pure 0.01% HOCl) compared with OTC product (0.02% HOCl)

Dmitri Debabov, Ph.D., Camron Noorbakhsh, Lu Wang, Ph.D., Kathryn Najafi-Tagol, MD, Ramin (Ron) Najafi, Ph.D., David Stroman, Ph.D.

NovaBay Pharmaceuticals, Inc., Emeryville, California, U.S.A.

## Key Facts

- Avenova is the first and only product in eye care containing pure hypochlorous acid
- A glass bottle is required to preserve the safety and efficacy of pure hypochlorous acid
- 3 year shelf life for an unopened 40mL bottle of Avenova
- Alternative manufacturing processes for hypochlorous acid produces hypochlorous acid with sodium hypochlorite impurities

## Summary

Avenova is the only non-detergent based, prescription lid and lash hygiene product containing pure hypochlorous acid. The manufacturing process for Avenova utilizes a patented technology to produce pure hypochlorous acid. Other hypochlorous acid products are either manufactured by Dakin's process or by electrolysis, both of which produce significant amounts of sodium hypochlorite impurities. A common household product that contains sodium hypochlorite is bleach, e.g. Clorox®.

## Pure Hypochlorous Acid is Produced by White Blood Cells

Hypochlorous acid is an essential component of the microbial killing capacity of neutrophils (a type of phagocytic white blood cell), enabling our body to defend against bacteria, viruses and fungi.<sup>1,2,3</sup> The respiratory burst, or oxidative burst, is a rapid release of reactive oxygen species occurring in neutrophils allowing degradation of bacteria and other foreign material as a part of the immune system.

Rates of oxygen uptake increase when neutrophils are exposed to certain stimuli, and they start to produce large amounts of superoxide ( $O_2^-$ ) and hydrogen peroxide ( $H_2O_2$ ). This reaction is catalyzed by NADPH oxidase. The  $O_2^-$  then reacts with  $H^+$  to produce oxygen and  $H_2O_2$ . This reaction is catalyzed by superoxide dismutase. Myeloperoxidase uses  $H_2O_2$  to catalyze the oxidation of  $Cl^-$  to hypochlorous acid, the microbicidal agent in the respiratory burst.

## Cytotoxicity

Avenova at 0.01% was compared with a 0.02% hypochlorous acid product (which contains significantly higher levels of sodium hypochlorite impurities) for cytotoxicity.

The cytotoxicity testing was conducted using L-929 (ATCC® CCL-1TM) mouse fibroblast cells by the method detailed in Rani et al. Cytotoxicity is defined as less than 50% of viacell count compared to untreated cells.

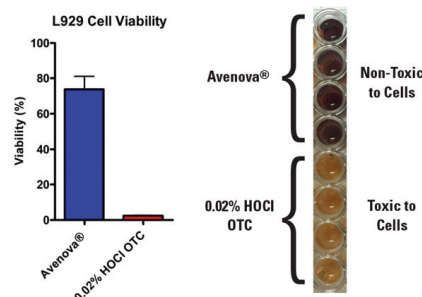


Figure 1.

The cytotoxicity testing results showed the Avenova viable cell count was  $73.77\% \pm 7.32\%$  as compared to the Untreated Control. On the other hand, when the 0.02% hypochlorous acid product was assayed, the viable cell count was  $2.44\% \pm 0.24\%$  as compared to the Untreated Control.

Therefore, in this cytotoxicity assay, Avenova was noncytotoxic, whereas the 0.02% hypochlorous acid product was cytotoxic (Figure 1).

## Conclusion

In direct comparative testing, Avenova proved to be non-cytotoxic by greater than 70%, while the 0.02% hypochlorous acid product was ~97% cytotoxic (as defined above).

## Works Cited

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3. Yu MS, Park HW, Kwon HJ, Jan YJ. The effect of a low concentration hypochlorous acid on rhinovirus infection of nasal epithelial cells. *American Journal of Rhinology & Allergy*. 2011;25:3545