

Sulfuric Acid Drain Openers

by
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1.0 Introduction and Background

In 1977 Hercules Chemical Corporation (Hercules) petitioned the Consumer Product Safety Commission (CPSC) to ban sulfuric acid drain openers (SADOs) from consumers and to limit their use to trained professionals.

The CPSC's Technical Advisory Board (TAB) enthusiastically endorsed the petition but before the ban could be implemented an ad hoc group of SADO producers calling themselves the Associated Chemical Producers (ACP) began to lobby the CPSC to oppose the ban. As a result, in 1981 the CPSC decided to reverse itself on the proposed ban, much to the expressed and documented disappointment of Hercules. There was another petition to the CPSC to ban SADOs in 1994 by Roger Wabeke, a consultant in chemical risk management. The CPSC performed another review of injury data and in 1996 again decided against banning SADOs. The photo below is an example of an injury that could have been avoided if the CPSC had banned SADOs from consumer use in 1977 or 1994.



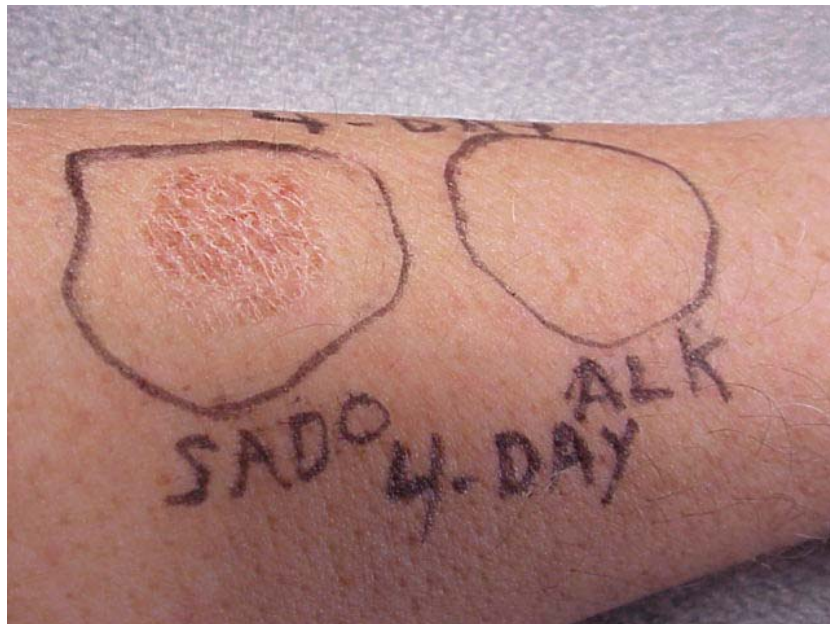
2001 SADO Injury

Because of my involvement as a chemical expert in sulfuric acid drain opener (SADO) accidents, I have had the opportunity to review the CPSC's actions in 1997, 1981, 1994 and 1996. This report documents my findings and conclusions based on that in-depth review.

2.0 CPSC's 1981 and 1996 Decisions

The Commission never said that SADOs were not dangerous. They simply said that SADOs were no more dangerous than alkali drain openers (ALKDOs). For the record, in my petition to the CPSC to ban SADOs I have offered to perform a public demonstration. I will pour an amount of a common ALKDO on my forearm while a member of the CPSC pours an equal amount of a concentrated SADO on their forearm. We will then determine who runs for the water first and whose injuries are the greatest.

The reason I can make this challenge is that, in addition to seeing the horrific results of SADOs, I have performed the proposed demonstration on my own arm using both ALKDO and SADO simultaneously. I applied the ALKDO first and then the SADO, and then rinsed them both off once the SADO became a serious concern, which was within 25 seconds. The picture above illustrates the results after four days. The SADO produced a second-degree burn (which later scabbed over) while the ALKDO did not even cause minor skin irritation. There can be little doubt that SADOs are more dangerous than ALKDOs.



Comparison of SADO vs. ALKDO Skin Contact 4-Day Results
SADO contact time was 25 seconds
ALKDO contact time was 37 seconds

I have also performed exposure tests on pigskin for longer periods of time. The results are shown below. The sample on the left was exposed to a SADO while the pigskin on the right was exposed to an ALKDO.



SADO vs. ALKDO Tests on Pigskin
Sample on Left was exposed to SADO
Sample on the right was exposed to ALKDO

3.0 CPSC's 1981 and 1996 Actions

Instead of the 1978 ban, the Commission decided to allow the SADO industry make voluntary improvements in packaging and labeling.

Unfortunately, the CPSC never realized that the voluntary industry effort to improve the safety of SADOs was being put into the hands of a single individual who did not understand the first thing about the chemistry of sulfuric acid, did not have any formal chemistry education or training, did not have any label or human factors education or training, did not have any packaging training, and he was not going to hire anyone (even as a temporary consultant) who had the proper education and training to help him and the ad hoc Association of Chemical Producers (ACP) make SADOs safer for consumer use. In other words, I do not believe that the CPSC realized that they were turning over this important public safety mission mostly to one individual who was basically void of any type of education or training relevant to the chemical safety task at hand. More importantly, as a recent 2002 SADO burn injury shows, the ACP has not convinced other SADO manufacturers to comply with the voluntary standards.

4.0 Flaws in CPSC Logic

The fundamental flaw in the CPSC's logic when they reversed their ban was to compare the percentage of sales of SADOs to the percentage of SADO injuries relative to the total sales and injuries of all liquid chemical drain openers (see June 20, 1996 response to Petition HP 95-3). On that basis, it appeared that SADOs were no more hazardous than ALKDOs. In other words, it appeared that the percentage of SADO sales was proportional to the percentage of SADO burns.

However, the CPSC did not pay close attention to their own in-house data to the effect that only 1/3rd of the SADOs were sold to ordinary consumers and 2/3rds were sold to professionals. Since professionals are trained in the use of chemicals (per the OSHA Hazard Communication Standard) they would be far less likely to sustain a chemical injury. Furthermore, the CPSC excluded work-related injuries. When you compare sales to ordinary consumers (3.1%) relative to the SADO injuries (11%) it becomes clear that SADOs are at least 3.5X more dangerous than ALKDOs.

The staff of the CPSC (see Roy Sammarco Memo dated February 24, 1981) suggested that the consumer's exposure to ALKDOs might be as much as 280 times higher than their exposure to SADOs. If true, SADOs should contribute only 0.36% of all drain opener burns. Yet, SADOs account for at least 11% of all burns (which I believe is an under-estimate). These figures suggest that SADOs may be 30X more hazardous than ALKDOs.

5.0 Voluntary Label Improvements

In Table 1 of Tab B (page 5 of the February 1996 report) there were 120 injuries due to SADOs in 1980. In 1981 the ACP stepped in with their improved label and the injury rate never went below 120 since. It was 170 in 1982 and other years were all above 200. In 1993 there were 680 SADO injuries. This strongly contradicts any notion that the "improved" labeling by the ACP had any measurable effect on injuries. The years close to 1980 (81 & 82) showed marked increases thereby ruling out the gradual increase in sales of SADOs over the years to account for the increases in injuries.

Even a manufacturer of SADOs testified that you need to see reduction in injuries to establish that the new warnings are working. Since we do not see a reduction in injuries it can be concluded that the warnings are not working.

6.0 Risks v. Benefits

There is absolutely no merit to the argument that SADOs are easy to use and offer sufficient economic benefits to offset their risk. It is not a life-saving or otherwise essential chemical product. It is simply a drain opener. There are other, less-risky and less-costly ways to unclog a drain.

Assuming the average number of yearly SADO injuries is 354 (per CPSC 1981-1994 data) and the total average cost per injury is \$100,000, the total annual cost of SADOs calculates out to be \$35.4 million. Over a ten-year period that becomes \$354 million. Note ACP's own data indicates 391 injuries in 1977 alone.

Had the consumer SADO industry shut down in 1980 the economic impact would have been the loss of about 73 jobs (per ACP documents). Admittedly, this did not include all SADO producers, but it could be argued that 2/3rds of the 73 jobs are in the production of SADOs for professional use.

U.S. companies lay off 1,000's of workers almost every day and firms like World Com, Kmart and Enron go bankrupt. These laid-off people eventually find other employment, most likely within a year or less. Hence, the total economic loss to the SADO industry would be on the order of $1/3 \times 73 = 24$ employee-years. If each employee-year was worth \$30,000 that would calculate out to be \$0.72 million. That doesn't even come close to the \$35.4 million in SADO injuries in one year or \$354 million in ten years. This does not consider the toll in terms of the immediate pain and suffering of a SADO victim or the longer-term emotional consequences of disfigurement. Also, it is likely that jobs would be gained in the ALKDO industry. The same logic might be applied to plungers and snakes. More of those might be sold and there would be more jobs in those industries.

It should be further recognized that a consumer ban on SADOs would not be a total ban. Companies that once focused on the consumer market could re-direct their efforts at professional plumbers who would be able to continue the use SADOs. The SADO producers might also re-direct their efforts at alkali drain openers for consumer use.

Furthermore, if the CPSC took the position that SADOs should only be sold in one-shot containers, no jobs would be lost from the SADO industry.

The above discussion of risks and benefits does not even include the well-known corrosion and materials problems that SADOs can cause when misused in plumbing systems.

7.0 SADO Crime

Sulfuric acid is a dangerous chemical. In Bangladesh, throwing acid in a woman's face is a growing crime, called the *barbaric crime of the century*." Some Bangladesh men have thrown acid in the face of women after they refuse a marriage proposal. Many women are blinded, lose their hearing, or die.



In Ohio, a man was sentenced 16 years in prison for throwing acid on four people. An article in The Journal of Trauma, March 1998 reported that the University of Louisville Kentucky School of Medicine noticed a substantial number of both accidental *and intentional* burns caused by SADOs. Of 21 reported SADO burn cases, 13 involved the use of SADO as a weapon.

The only reason SADO crime is mentioned in this report is to further show that SADO is a powerful chemical capable of horrific injuries and crimes. In many ways, it is an ultimate personal weapon perhaps more feared than a gun or knife.

8.0 CPSC History of Product Recalls

The CPSC will recall and ban products that present far less danger to society than SADOs. The following is brief list of examples of products that have been recalled:

1. CPSC recalled 136,000 cans of Fire Cap fire and smoke suppressant even though it was not aware of any injuries. The recall was conducted to prevent *possible* injuries.
2. CPSC recalled 190,000 cans of Party Time "Happy String" because it is flammable and one four-year old boy received only 1st and 2nd degree burns on his face and arm. A woman was burned on her ear in another incident.
3. CPSC recalled 912,000 can of "Crazy Ribbon" and "Crazy String" because of flammability. One 11-year old boy suffered serious burns that left permanent scars.
4. CPSC recalled 80,000 Martha Stewart Potpourri Simmering Pots. One consumer received minor burns.
5. CPSC recalled 618,000 Star Wars Light sabers. There were 3 reports of minor burns and one consumer experienced an eye irritation.
6. CPSC recalled 24,000 Martha Stewart Brand Tea Kettles. There were 3 minor burn injuries.

7. CPSC recalled 296,000 cans of aerosol “Smatter” spray foam. One child reportedly suffered a minor bump on the head when a can of Smatter broke apart (exploded) in a hot car.
8. CPSC recalled 200,000 cans of Simonize Quick Gloss because the aerosol container may rupture (explode). No injuries were reported.
9. CPSC recalled 500,000 cans of Shave Gel because the container may corrode and rupture. No injuries were reported.
10. CPSC recalled 124,400 Soap Making Kits. There were 10 reports of children being burned.
11. CPSC recalled 50,000 cans of EASY-OFF because an improperly attached valve assembly can separate from the can. There were 12 reports of burn injuries to skin and eyes. Note that EASY-OFF is chemically similar to alkaline drain openers.

9.0 CPSC History on Product Bans

The following is a very brief list of some products that were ban by the CPSC. Note that item B is the ban of a particular product size.

- A. CPSC banned Large Reloadable Shell Fireworks. There were a total of 39 incidents from 1985 thru 1991. During this 6-year period 31 injuries were reported or 5.16 per year. This should be compared to the 3,271 injuries per year from chemical drain openers and the 354 from SADOs.
- B. CPSC banned extremely flammable contact adhesives sold in larger than one-half pint containers. Since 1970 there had been 130 injuries including 15 deaths, or 4.81 injuries per year and 0.55 deaths per year. This should be compared to the 3,271 injuries per year from chemical drain openers. **It should also be noted that this was a ban of a SIZE of a product.****
- C. CPSC banned toy phonographs because of possible electric shock. No injuries had been reported.

The point of listing some examples of CPSC recalls and bans is to accentuate the inconsistency of the CPSC in performing their duty to protect the consumer from unreasonable risk.

10.0 Kleenex Syndrome

Another flaw in the CPSC's earlier process is what I call the "Kleenex Syndrome." If you ask someone for a Kleenex, they might hand you a Charmin Bath Tissue. The problem is that Kleenex has become a descriptor for an entire product type. Somewhat like a Xerox copy, even though Xerox is no longer the most common copying machine.

Likewise, Liquid Plumber has become more or less a generic term for liquid drain openers. Therefore, the comments section of the NEISS database might say that Liquid Plumber was the cause of a patient's burns when in fact it may have been another type of liquid drain opener.

Since Liquid Plumber is an ALKDO, those burns would automatically fall into the ALKDO column and might be missed as SADO burns without further questioning of the patient. Also, the hospital staff might enter Liquid Plumber in the Comments Section even if the patient said it was some other type of liquid drain opener. Even the patient themselves might be confused and say it was Liquid Plumber as the distinction between SADO and ALKDO is not immediately obvious to the ordinary consumer.

Most would agree that people are as likely to spill Coke on themselves as they are Pepsi. Both Coke and Pepsi come in the same sizes and shapes of containers and are about the same weights and slipperiness. The same is true for SADOs and ALKDOs. Therefore, one would expect people to be about as likely to spill a SADO on themselves as they are an ALKDO.

Concentrated sulfuric acid (93-99%) is so much more hazardous than the typical 10% sodium hydroxide solutions used in ALKDOs that it simply does not make sense that SADOs and ALKDOs present the same danger. There are at least five mechanisms by which SADOs can damage skin (heat, acid, dehydration, oxidation and sink eruptions) while ALKDOs present the single mechanism of alkalinity. In other words, the likelihood of exposure would be expected to be proportional to sales, but the odds of injury are much greater for the SADO.

The bottom line of the Kleenex Syndrome is that the data found in the comments sections of NEISS databases is likely to be falsely weighted toward ALKDOs as the cause of burns. And the Coke-Pepsi analogy tells us that the likelihood of injury from a SADO exposure is far greater than for an ALKDO and any conclusion to the contrary simply doesn't make sense.

11.0 CPSC – Miscellaneous Notes

In 1981, there was no consensus in the CPSC about a course of action re SADOs. The team agreed that the theoretical evidence of the potential of SADOs to cause immediate and severe injury plus the apparent difficulty by consumers in safely following label instructions support the contention that the SADOs should be banned for all but professional use. The Directorate for Compliance and Administrative Litigation said that the hazards of SADOs could be addressed adequately only through a banning action. The Directorate of Health Sciences abstained from making a recommendation, but in 1978 they made a very strong recommendation to ban SADOs. Hence, it does not appear that there was any real consensus within the CPSC about SADOs. The Commission appeared divided, even in the face of ACP lobbying.

Per CPSC, between 1980-1994 there have been 5,070 SADO related injuries. (Total chemical drain opener injuries is 49,070.) 11% involved hospitalization or death. $11\% \times 5,070 = 557.7$. It's difficult to compare the economic hardship of 73 healthy workers who might have to find new jobs to 557.7 who may not ever be able to work again or could be seriously handicapped. Assume that all 73 of the ACP workers would have been out of work one year. The total loss would have been 73 man-years. Some of that loss would have been covered by unemployment benefits. Some by companies finding other positions for the laid-off workers. There might have also been some type of job training program to benefit these 73 workers in the longer term. One would also want to look at employee turnover in the SADO industry before making a firm judgment about the long-term (employee) cost of a ban. Filling bottles with concentrated sulfuric acid would not seem to be a highly sought after career.

If the average injury rate of 354/yr from SADOs were projected from 1994 to 2004, there would have been another 3,540 injuries thru 2004 of which 11% (389) would have involved hospitalization or death. Compare this to 73 (uninjured) industry workers who might have to look for another job.

CPSC had 16 Death Certificates associated with chemical drain openers 1980-1994. At least three were known to be for SADOs. Assume these 3 SADO-injured people each had an average of 25 working years remaining, the lost man-years from the economy workforce was 75. That is greater than the 73 man-years that would have been lost had the ban been enforced. This does not include the deaths or man-years lost since 1994 thru 2004, another 10 years. It does not include lost man-years from injuries without death.

Keep in mind that 2/3 of the SADO sales are to professionals, therefore the loss of all 73 jobs would have been unlikely.

In 1981 the CPSC recommended the following for SADOs:

- Low-Flow containers
- Low-spill containers
- A time-based safety factor
- One-shot containers
- Outer cardboard boxes to allow for more prominent warnings and instructions.

The Ad Hoc ACP report to CPSC in 1981 states:

“However, if for any reason the Commission determines that additional safety measures should be considered, ACP pledges its full cooperation to assist the Commission in that regard.”

- ❖ Did ACP use one-shot containers? No.
- ❖ Did ACP use containers less likely to tip over? No.
- ❖ Did ACP use low-flow containers? No.
- ❖ Did ACP use a time-based safety factor? No. (Except One)

To my knowledge, none of the above CPSC recommendations were implemented by the SADO industry.

It is my further opinion that:

- a) SADOs present a high degree of risk of harm to a person,
- b) The harm to an untrained consumer will most likely be great,
- c) The risk is difficult to eliminate by the exercise of reasonable care or labeling given that accidental spillage is a common human occurrence, particularly for the ordinary and untrained consumer who also is not trained how to respond in a timely manner.
- d) The use of concentrated sulfuric acid is not a matter of common usage by the ordinary consumer, and
- e) Risks greatly exceed benefits.

In many states, the above criteria fit the legal definition of an ultra hazardous activity.

12.0 Summary and Recommendations

It is my professional opinion, as someone who has spent his entire professional life in the field of chemistry, chemical safety and chemical accident investigation that:

- 1) Sulfuric acid drain openers (SADOs) are unreasonably dangerous and should not be sold to ordinary consumers. SADOs can cause horrific injuries and are unsafe when used in a reasonable and foreseeable manner by ordinary consumers. The risk of danger inherent in SADOs greatly outweighs their benefits.
- 2) SADOs should only be sold to professionals who have had the benefit of the training required by the OSHA Hazard Communication Standard.
- 3) If SADOs MUST be sold to ordinary consumers, they should be packaged in one-shot containers, and
- 4) If SADOs MUST be sold to ordinary consumers in one-shot containers, they should not be greater than 84% in concentration in order to provide a (slight) time-based safety factor and to reduce the thermal component of SA injury.