

## **Rainshow'r Technical Paper # Shower Filter Life**

1. Almost 25 years ago I developed an industry and a technology to reduce free chlorine using small plastic bodies at elevated temperatures and high flow rates.
2. It had never been done before.
3. Since then we have manufactured almost a million devices to reduce chlorine in showers, baths, gardens and hydroponic hot houses. We also spawned a few imitators.
4. At this point easily 95% of all dechlorination equipment, mostly shower filters, copy Rainshow'r's technology. Most of the original U.S. copiers have atrophied and now it is mostly Rainshow'r and a few low volume of U.S. companies and a growing clutch of Asian companies.
5. The technology is hardly a secret. It is fully described in technical papers found on our website. What we are going to discuss in this technical paper is the thorny issue of how long does a shower filter last.
6. The issue is thorny because the activating media we use does not do anything to chlorine. When we say it does nothing we mean it does zero, zilch, nada to chlorine. What it does do is generate electricity. Perhaps as much as 1100 or 1200 milli volts of electricity. See item #15
7. The media we pioneered is called KDF. Depending on the type that is used it is a brass alloy with varying amounts of copper and zinc. We use

KDF<sup>®</sup> in a ratio of 85% copper/25% zinc, 70% copper/30% zinc, but mostly we use it in a 50%/50% alloy of copper and zinc called KDF55<sup>®</sup>.

8. Our ability to make a functioning shower filter or any other dechlorination device is based on our knowledge of the chemistry and physics of the KDF<sup>®</sup> media, our knowledge of water and how particulate matter impacts on the media.

9. O.K. then how long will a filter last? There are five factors that affect filter media;

- **Temperature**, the hotter the water the better it works.
- **Flow rate**, the lower the flow rate the better it works,
- **Mass**, the more media that is used, the better it works,
- **Sediment or particulate matter**, the more there is in the feed water the shorter the life.
- **Amount of water**, measured by the number of users or the length of showers.

10. Unless you understand those five factors or copy Rainshow'r technology you may not have as good a filter as you would like. But, we still haven't explained how the life of shower filter can be negatively affected.

11. The principal factor which affects shower filter life is in one word; **dirt**. In order to create free chlorine (one of four halogens) you generally will rely on the creation of an electro-chemical environment such as a

brine solution into which positive and negative electrodes are immersed. When the electricity is turned on it allows the separation of the chlorine from the sodium in this brine (sodium/chloride) solution.

12. Since chlorine is a halogen (only seven electrons) in its outer ring it makes a great pathogenic bacteria killer, because in the absence of an electrical charge it will seek to combine with organic matter (such as bacteria).

13. That's fine for pathogenic problems, but your body is entirely organic therefore it can be negatively affected by Free Chlorine (CL<sub>2</sub>). How do we get rid of it or at least reduce it in a shower, bath or garden setting. What you need is electricity. How? From where?

14. What Rainshow'r discovered 25 years ago was that if you placed copper and zinc, as a brass alloy, in an aqueous solution the molecular tension between these two metals would generate electricity. The electricity created by these metals would generate the 1100 to 1200 millivolts needed to create the galvanic charge required to duplicate the environment that originally separated chlorine from sodium in that brine solution.

15. This galvanic action allows a dechlorination unit to take two ions of chlorine and combine them into a simple, soluble and harmless chloride (in very minute amounts) with calcium or potassium or other prevalent metal in the water which is then washed out of the device.

Terrific, except for the dirt.

16. As sediment enters the device some of it will settle on the surface of the KDF<sup>®</sup> atomized brass. This has the effect of insulating the brass granules from each other. This then begins to reduce the galvanic action from 1200 millivolts to 1100, 1000, 900 etc, etc until there is not enough electricity to convert the free chlorine into the harmless chloride we want.

17. Depending whose figures you wish to believe there are from 60,000 to 160,000 water treatment plants throughout the United States. Those figures should begin to reveal that water coming from lakes, rivers, wells, aqueducts, etc, etc will vary in their quality and content.

18. It is no wonder then that given all these variables it becomes difficult to set specific performance specifications on a small plastic shower filter. Looked at from a hardnosed engineering view point, a shower filter ought not to exist.

19. Why? You are asking a small plastic device to do too much, for too long with too little.

20. But, Rainshow'r made it work. That technology was then copied by a few companies. Their results will vary based on their engineering capability.

21. What we tried to point out in item 16 was that the sediment or dirt in a

home's feed water directly affects the reduction of chlorine. The implication should be obvious.

22. But, that makes it well nigh impossible for a responsible manufacturer to state is how long a shower filter or other dechlorination device will reduce chlorine to an acceptable level. As we have stated there are too many variables. Refer again to item 9.
23. What we at Rainshow'r have done is to rely on an average experience level gauged by the tens of thousands of users around the world over a 25 year period. That experience level as applied to each device allows us to make "best case" estimates. Is it perfect? No it is not. But, it has been pretty close.
24. Our position on filter life is based on all that we have learned plus our policy to understate, not overstate, performance results. An example of that is our CQ-1000 shower filter model. Before NSF/ANSI developed certification rules for shower filters the CQ-1000 was tested at the KDF<sup>®</sup> lab in Michigan about fifteen years ago.
25. The testing protocol or procedure was developed by both the KDF<sup>®</sup> company and Rainshow'r. The testing protocol we developed was later adopted by NSF as their shower filter testing procedure. Rainshow'r is still a member of the original committee that wrote the test procedure.
26. That first CQ-1000, testing showed that at one part per million of chlorine (less than the U.S. average) the CQ-1000 reduced chlorine

at 90% or more for 000 gallons, but, we have never claimed 50,000 gallons. Our policy position on filter life is a recommended change or replacement at a much earlier point.

27. Since we do not know how a shower filter will be used nor do we know the quality of the water where it is being used we set estimated limits. As an example;

- The 12½ 502 or Cameo (non cartridge), replacement at 9 to 12 months.
- The CQ-1000 15½ oz (cartridge) replacement at 6 to 7 months in the hope that the user changes it by 12 to 15 months.
- The New Century 18oz (non cartridge). Replacement at 15 to 18 months in the hope that the user replaces it by 24 months.
- The Crystal Satellite 20 oz (cartridge), replacement at 18 to 24 months. All of the above are estimates only because of the variables involved.
- We have users who have used their original shower filter for three to four years.

28. The reason for the variation among the filters is the amount of media (KDF55<sup>®</sup>) used and the size of the polyester pre-filter which can be from ¼ inch to one inch thick. The KDF<sup>®</sup> filter media amounts can run from 12½ oz in the 502/Cameo to 20 oz in the Crystal Satellite.

29. Before we finish this technical paper we need to comment on our use of energized virgin crystal. We are the only company that uses American virgin crystal whose energy we increase through our own non-chemical process. The crystal is used in all of our

dechlorination products. Because of its inherent electro-magnetic action it breaks large water clusters into smaller water clusters. It acts much like a mechanical surfactant. It makes the water wetter. It does not soften the water, but it does make it feel “lighter”. Our 20 year experience in using crystal has indicated not only very good customer reaction, but very important, it appears to lengthen the operational life of the filter.

30. Perhaps it would be useful to illustrate that our estimates on the useful life of shower filters and other dechlorination products are based on very real experience. That experience is reflected in how much material we use. Just in the last ten (10) years alone we have used over 150 tons (300,000 lb) of KDF<sup>®</sup> atomized brass and 60 tons (120,000 lbs) of American crystal. That would seem to indicate that from a customer’s point of view we must be doing something right.

We hope this technical paper has been of use in understanding Rainshow’r dechlorination products.

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