

Purves Environmental Inc.

Environmental Research and Consulting since 1993

M.A.R.S. Bio-Med LibertyBOSS Amalgam Separator Study

Purpose

The purpose of this study is to examine the discharge from a separator that uses a treatment media to remove dissolved mercury and solid amalgam from a dental discharge. Most separators remove amalgam by simple gravity separation. The basic system consists of two chambers in which the vacuum air containing both waste water and solid amalgam and air is separated. The waste water and solid amalgam enters a chamber where the gravity separation of water and solid amalgam takes place. The other chamber allows the vacuum to be maintained without amalgam entering the vacuum system. The assumption is that all of the amalgam is captured and no mercury enters the discharge into the POTW. The assumption is completely false as the following data will demonstrate.

Separator Comparison

The data in Table 1 is from separators taken in various dental offices. The total mercury is from a sample taken as it discharges from the separator. The dissolved mercury is a filtered sample taken from the total mercury sample. The separator type is identified in the last column. None of the first 6 separators has any type of treatment. Separator #7 is a M.A.R.S. LibertyBOSS separator that has treatment. Separator #3 is from the same office as Separator #7. The Hg5 separator was removed and M.A.R.S. system was installed. Both separators operated for 5 months or more before the samples were taken.

Table 1

Office	Total Mercury from the Separator in ng/L	Dissolved Mercury from the Separator in ng/L*	Separator Type
1	17,500,000	7,500,000	Hg5
2	7,290,000	2,530,000	Hg5
3	660,000	452,000	Hg5
4	534,000	378,000	Hg5
5	1,250,000	811,000	Medentex
6	10,200,000	5,210,000	DRNA
7	65,600	36,600	M.A.R.S LibertyBOSS

*Dissolved mercury content based upon filtration of the discharge through a 0.7 um filter.

Average Dental Office Discharge Volume

Data collected by various dental vacuum manufacturers indicated that the average volume of water discharged is 2 gallons per day per operating chair. Each chair may not be performing amalgam removal or placement but the separator water is being actively exchanged. The exchange of water removes water that has dissolved and suspended amalgam often causing an initial slug of highly contaminated water to enter the waste water system. A current study underway demonstrates this issue. Samples were taken daily at the same time each day for five days after the installation of a new M.A.R.S LibertyBOSS amalgam separator at the vacuum system discharge. The vacuum system plumbing was not replaced. The residual (background) level of mercury in the system was taken as a starting point.

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Table 2

Sample Description	Day Sampled	Result
Back ground water sample from the discharge side of the pump.	Day 1 Thursday	4840 ng/L
Sample from the discharge with old separator in place. Operated 5 months	Day 1 Thursday	87700 ng/L
Sample from discharge after new separator is installed.	Day 1 Thursday	5050 ng/L
Sample from Discharge	Day 2 Friday	8230 ng/L
Sample from Discharge	Day 3 Monday	46700 ng/L
Sample from Discharge	Day 4 Tuesday	3310 ng/L
Sample from Discharge	Day 5 Wednesday	21300 ng/L

The concentrations will vary day to day based upon activity within the dental office. As the study continues the data will reveal a more accurate discharge history within a dental facility. The type of separator used has a treatment material within the amalgam separator that removes ionic and elemental mercury. The removal is highly dependent upon the flow rate through the separator at the time of sampling and the activity within the office.

High concentrations of mercury will typically be found on days after no office activity such as Mondays. The amalgam can sit in the water and continue to dissolve over the weekend creating a high concentration of dissolved mercury. Low concentrations will be experienced on days when no amalgam removal or placement is being performed. The concentration increases as amalgam is being removed or placed due to the grinding process. This is primarily due to particle size. When particle size is very small the dissolution rate of the amalgam will be very rapid.

Additional Assumptions

The rate of dissolution reduces over time as the water hits a saturation point. The change of pH from 7.0 will increase the dissolution rate. A pH less than 5 or greater than 9 may increase the dissolved mercury concentration substantially. The pH of the offices studied ranged in a pH of 6.8 to 8.0.

All of the separator manufacturers claim a 6 months or more life on the separator efficiency of 99% minimum. The samples taken for this study assumes that the separators and vacuum systems are maintained as recommended by the manufacturers. Most dental offices do not keep records regarding maintenance of their systems. In most cases they may know when the separator was last changed but system cleaning and maintenance is not available.

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Conclusion

Properly designed separators will remove 99% of the solid amalgam from the environment, however, the dissolved mercury will remain an issue for POTWs as discharge limits continue to be reduced. Municipalities and POTWs that wish to be proactive in a mercury reduction plan will have to look very seriously at not only Best Management Practices (BMP) but "Best Available Technology". The M.A.R.S. LibertyBOSS amalgam separator is the "Best Available Technology" at a competitive price.



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