

Used Antifreeze

Antifreeze is a generic term used to describe a solution of a glycol-based liquid and water that lowers the freezing point of the solution. Antifreeze offers more than just freeze protection for motor vehicles. The boiling point of the solution is also higher than that of plain water, thus providing overheating protection in the summer by transferring heat from the engine to the radiator⁽¹⁾.

There are two major types of antifreeze, one made from ethylene glycol (EG) and a newer version made from propylene glycol (PG). Propylene glycol is considered the more 'environmentally friendly' version simply because it is less toxic to humans and animals if consumed, however it is still poisonous. Both types of antifreeze have a toxic nature, even before use. Upon ingestion, ethylene glycol forms oxalic acid, resulting in depression, then heart and breathing difficulty, kidney failure, brain damage and even death⁽²⁾.

Besides already having a toxic nature, antifreeze becomes contaminated with dirt, traces of fuel, oil and metals such as copper, lead and zinc during use. Antifreeze can also have high enough concentrations of cadmium and chromium to deem it a hazardous waste⁽³⁾. Antifreeze itself breaks down to form acids that can corrode engine parts. If mixed with anything other than distilled water, dissolved minerals in the solution can cause scaling problems in the cooling system. Therefore, additives are also present, raising and stabilizing pH, providing corrosion and scaling prevention in the engine and radiator, preventing foaming and slowing the breakdown of EG^(1,3).

Worldwide, over 400 million gallons of antifreeze concentrate are sold each year, resulting in about 800 million gallons of coolant. It is estimated that 25-50% of this is improperly released to the environment. Approximately 90% of the remainder is mixed with wastewater, treated and released to surface waters. Because ethylene glycol is a petrochemical, its price rises and falls with the price of crude oil. It is a non-renewable resource, and technology is readily



References

- (1) EET Corporation, Antifreeze Frequently Asked Questions. <http://www.eetcorp.com/antifreeze/antifreeze-faq.htm#q1>
- (2) National Oceanic and Atmospheric Administration Safety and Environmental Compliance Office, United States Department of Commerce, <http://www.seco.noaa.gov/ENV/Factsheets/antifreeze.html>
- (3) Utah Department of Environmental Quality, Pollution Prevention Fact Sheet, 'Antifreeze Recycling and Disposal.' <http://www.hazardouswaste.utah.gov/SWBranch/Adobe/P2Factsheets/AntifreezeRecyclingFactSheet.pdf>
- (4) Minnesota Pollution Control Agency, Waste/Hazardous Waste #4.02, 'Managing Waste Antifreeze,' revised August 2004. <http://www.pca.state.mn.us/publications/w-hw4-02.pdf>
- (5) United States Environmental Protection Agency, Municipal Solid Waste, Antifreeze, revised June 2006. <http://www.epa.gov/garbage/antifree.htm>
- (6) United States Environmental Protection Agency, Department of Solid Waste and Emergency Response, 'Comprehensive Procurement Guidelines, Buy-Recycled Series, Vehicular Products.' May 2004. <http://www.epa.gov/epaoswer/nonhw/procure/products/engine.htm>

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available to recycle and reuse it⁽¹⁾. Recycled antifreeze prices tend not to fluctuate with crude oil prices so over time may be less costly than purchasing virgin antifreeze⁽⁴⁾.

For facilities that maintain fleet vehicles, using long-life (organic acid technology or OAT) antifreeze is a viable option. OAT antifreeze can be recycled, however it must be ensured the chosen recycling method completely removes the chemical additives to the antifreeze. Some evidence has shown that OAT antifreeze may cause additional engine problems, such as silicone seal degradation after 80,000-100,000 miles. Hybrid organic acid technology (HOAT) antifreeze has evolved, and offers good long-term protection and so far hasn't shown negative side effects⁽¹⁾. Long-life antifreeze differs from conventional antifreeze only in the additives. It is intended to last 5 years or 150,000 miles, and heavy-duty long-life antifreeze lasts between 400,000 and 600,000 miles with use of a one-time life extender⁽⁵⁾.

Used antifreeze should never be mixed with other wastes, and it must undergo a hazardous/non-hazardous waste determination before disposal/treatment. Used antifreeze should never be dumped down the drain, or into a septic system. The best solution for used antifreeze is to recycle it⁽³⁾. Testing has shown that recycled antifreeze meets nationally recognized performance standards, such as those followed by the American Society for Testing and Materials (ASTM). In fact, recycled antifreeze may actually be superior to virgin antifreeze since the recycling process removes chlorides commonly found in hard water⁽⁶⁾.

There are several methods used for antifreeze recycling including filtration, distillation, reverse osmosis, and ion exchange. Three common and practical methods for recycling used antifreeze are discussed:

- [Onsite Closed-Loop Recycling](#)
- [Onsite Batch Recycling, and](#)
- [Offsite Recycling](#)

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Antifreeze Recycling Cost Worksheet

* Most Information derived from the fact sheet *Antifreeze Recycling, Best Environmental Practices for Auto Repair and Fleet Maintenance*, United States Environmental Protection Agency, Department of Toxic Substances Control, November 2001

* This worksheet is meant to give an approximation of costs and payback periods

CURRENT GENERATION IN YOUR FACILITY		EXAMPLE
A	Approximately how many gallons of used antifreeze do you generate per year?	2,000
B	How do you currently dispose of your used antifreeze?	Off-site Recycling
C	How much do you pay per gallon for antifreeze disposal/recycling?	\$5.10
D	Has used antifreeze from your facility undergone TCLP testing?	No
E	How much money do you spend annually to purchase virgin or recycled antifreeze?	\$100
F	Total Current Annual Cost (A x C) + E	\$10,300
ONSITE MOBILE ANTIFREEZE RECYCLING SERVICE		EXAMPLE
G	Cost per gallon for mobile antifreeze recycling	\$3.29
H	Annual waste disposal costs (filters, residue, etc.), if any	0
I	Total Annual Cost for Mobile Recycling Service (A x G) + E + H	\$6,680
OFFSITE ANTIFREEZE RECYCLING SERVICE		EXAMPLE
J	Cost per gallon for offsite antifreeze recycling	\$5.10
K	Total Annual Cost for Offsite Recycling Service (A x J) + E	\$10,300
ONSITE RECYCLING - BATCH SYSTEM		EXAMPLE
L	Average time (hours) required to recycle one batch of antifreeze	15
M	Annual maintenance/repair costs	\$800
N	Unit purchase and shipping costs	\$10,850
O	Unit installation costs, if any	0
P	Annual cost for additives	\$10
Q	Annual cost for filters	\$50
R	Annual cost to TCLP test waste filters	\$300
S	Unit voltage (volts)	240
T	Unit current (amperes)	16
U	Energy cost per kilowatt-hour	\$0.12
V	Annual cost to dispose of recycling wastes (not antifreeze)	0
W	Total Capital Cost (N + O)	\$10,850
X	Total Annual Cost for Onsite Batch Recycling $E + M + P + Q + R + V + [(S \times T)/1000 \times U \times L]$	\$1,272

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Antifreeze Recycling Cost Worksheet (continued from previous page)

ONSITE RECYCLING - BATCH SYSTEM (CONTINUED)		EXAMPLE
Y	Annual cost difference [between onsite batch recycling and current disposal methods (F), onsite mobile recycling (I) or offsite recycling service (K)] $X - (F, I \text{ or } K)$	\$9,078 (F) \$5,458 (I) \$9,078 (K)
Z	Payback period in years for onsite batch recycling (W/Y)	1.19 yrs. (F)
ONSITE RECYCLING - CLOSED LOOP SYSTEM		EXAMPLE
AA	Average time (hours) to recycle antifreeze in one vehicle	0.5
BB	Annual maintenance/repair costs	\$800
CC	Unit purchase and shipping costs	\$8,150
DD	Unit installation costs	0
EE	Unit voltage in volts	230
FF	Unit current in amperes	6.25
GG	Total Capital Cost (CC + DD)	\$8,150
HH	Total Annual Cost for Onsite Closed Loop Recycling $E + BB + P + Q + R + V + [(EE \times FF)/1000 \times U \times AA]$	\$1,260
II	Annual cost difference [between onsite closed loop recycling and current disposal methods (F), onsite mobile recycling service (I), offsite recycling service (K), or onsite batch recycling (X)] $HH - (F, I, K \text{ or } X)$	\$9,040 (F) \$5,420 (I) \$9,040 (K) \$12 (X)
JJ	Payback period in years for onsite closed loop recycling (GG/II)	0.90 yrs. (F)