

Fog

by Joe Dunfee
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Theatrical fog effects are used for several purposes. Mostly they help to create a special "atmosphere"... transporting the audience away from the real world and taking them to the fantasy world you are creating for them. It may be used to actually represent physical fog in a theatrical setting or other things such as a fire, an accent for something supernatural happening, or for "Disco Lights" effects.

I will use the words "fog" and "smoke" interchangeably, although technically they mean different things. In actual use they usually mix them up, so it doesn't really matter which you use.

While there are colored smokes available in the "smoke cookie" form, they are not very breathable. However, any type of fog can be colored with lights - usually from behind against a dark background. White light can make the fog appear more dense. Red lights on fog can be very effective at representing Hell or simply a fire.

GLYCOL SMOKE MACHINES

There are several kinds of fogs and ways to make them. The most common is the glycol-based fogger, often called a smoke machine. This is a bread box sized piece of equipment that holds a reservoir of "fog juice" - a special mixture of water and glycol. When a button is pressed on a remote control, the machine pumps some of this fog juice into a heating chamber where it vaporizes. The fog then billows out the nozzle with a hiss. Fortunately, prices on these have dropped in recent years - I commonly see small units less than \$100. Check out a D.J. (Disk Jockey) supply store or a large music store for the cheaper kinds. Theatrical supply houses will, of course, carry other more elaborate versions.

Be aware that all of the middle-to-low end models have to stop every 10 minutes or so, to reheat its vaporizing element. During this 30 second interval you will not get any fog when you press the button. So, you may not want to use a model that does this if you plan on using the fogger to generate a "poof" at some critical time. You will probably have to pay more than \$200 to get one that doesn't do this. Glycol foggers should be cleaned regularly by running distilled water through it instead of the fog juice.

Personally, I have been in heavy glycol fog for many hours without any problems. Nevertheless, perhaps those with medical problems cannot do this. But, overall, this is a very breathable fog.

OTHER SMOKE PRODUCING METHODS

• There are also several other methods of smoke production and will discuss the dry ice method, in depth, in a moment. But first here are some other, less used, methods. I won't go in depth on things I am not familiar with, but to be complete, here are several less used ways of producing fog and smoke. Talk to your theatrical supply house for more information. Most of these other methods are not practical because of cost or other problems.

- **Pyrotechnic flash powder with smoke additive.**
- **Smoke cookies and Smoke Powder** designed to be ignited and allowed to smolder. Available in colors! \$12 per cookie.
- **Heating a chemical called "Sal Ammoniac"** is an older method of making theatrical smoke. It can be done in a pie tin on a hot plate or in special heater made for this application. Unfortunately, it is not nice to breath. \$20 per pound and \$20 for a heater.
- **Fog-in-a-can products.** An Aerosol product that sprays out a very subtle haze effect. It is way too subtle for anything but helping light beams to show up. About \$10 a can and it won't last long if the A/C is on.
- **Hazers** - as a class of machine, they make an extremely fine mist of either mineral oil or a glycol mixture. They don't use heat, and so there is never a risk of a burning smell. However, most are quite noisy in operation.
- **Water Mist.** It simply uses water and makes an extremely fine mist. The theme parks commonly use this where the audience will be exposed to it because this is guaranteed to not irritate even very sensitive people. I have seen this idea on a very small scale by using an ultrasonic room humidifier to simulate a boiling pot. Putting some glycerine in the water will help the fog to last longer.
- **Dry Ice.** These use Dry Ice immersed in hot water to work. The resulting fog is very heavy and hugs the ground. For very large scale settings, liquid nitrogen is used in a roughly similar process because it becomes cheaper in the long run.

CLASSIFICATIONS of FOG EFFECTS

In my observations, there are three main classifications for fog or smoke effects.

Smoke: This refers to a localized concentrated "poof" of smoke. Commonly, this is made from a glycol based fog machine. An example may be a fire in a house, usually accented with red flickering lights inside the burning structure. Another use for the concentrated smoke is to accent a supernatural event, such as the appearance of a Genie or for a magic trick.

The wisp of smoke rising from small open fire pit may best be represented by a smoke cookie or the "Sal Ammoniac" method, or a few burning cigarettes (yuck!)

Haze: A second use for foggers, is to generate a "haze" - a light fog. Usually this is done so that you can see the beam of a light shining through the haze. Sometimes this is so sparse an effect that it may not be noticed under regular lighting. I will talk about some of

these effects in another installment discussing lighting special effects. But, while a regular glycol based fogger can be used for this effect, there are special machines that do a better job. They are called "Hazers," of course.

Heavy Fog/Dry Ice Fog: It simulates the ground hugging fog that occurs in nature. It is a mandatory effect to do in every horror movie graveyard scene. It is also commonly used to represent heaven, where the angels are walking on the tops of the clouds (not theologically accurate, but theater doesn't need to be literal). It is usually produced with dry ice and often called "dry ice fog". This kind of fogger is easy to make yourself, and I will spend the rest of this article describing how. There are also other methods which try to simulate the dry-ice fog at less cost. They succeed in varying degrees. They work by chilling regular glycol-based smoke, some by mechanical refrigeration, but I will discuss other simpler ways to make a "chiller" yourself.

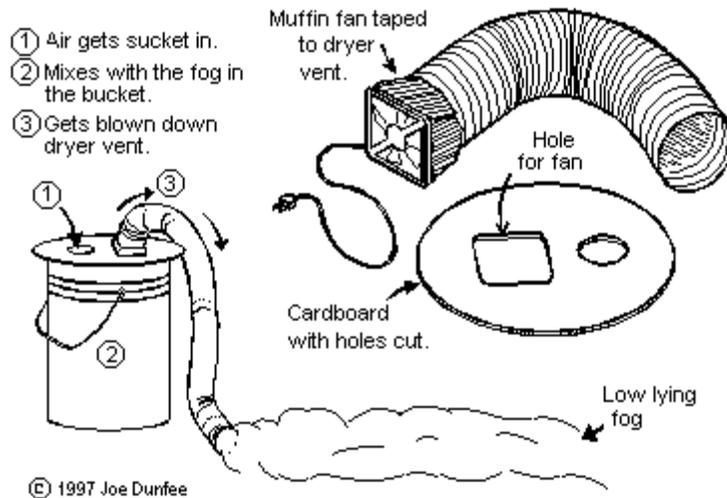
MAKING A DRY-ICE FOGGER

The principal is very simple. Dry ice is Carbon Dioxide (CO₂) gas that has been compressed and cooled until it has frozen solid. Simply dropping a small chunk of dry ice into a glass of water will melt the dry ice and generate the fog which bubbles out. Every mad scientist has this effect on his table to represent boiling chemicals. To make the heavy fog in large quantities, you simply scale things up.

CO₂ is EXTREMELY cold, so you should handle it with gloves to avoid any risk of frost bite. (simple cotton work gloves are fine) But it is actually pretty safe, and you can hold chunks of it in your bare hands, provided you hold it loosely and change your grip occasionally. Immersing the dry ice in warm water will cause the dry ice to rapidly melt. The solid CO₂ turns directly into a gas. (without becoming a liquid in between - thus it is "dry") The coolness of the gas also condenses any water vapor from the relatively warm water - making the gas cloudy. The results bubble up through the water, and because CO₂ gas is heavier than the air around us, it will flow out the container and onto the ground.

You can purchase dry ice by looking in the yellow pages under "ice". I pay \$1 a pound in Miami. A pound is about the size of a brick. The last time I used dry ice, I purchase 8 pounds Saturday afternoon, and stored it in a Styrofoam cooler. (it can damage plastic with the extreme cold - so don't store it in your freezer) By Sunday evening, I had about 5 Lbs.. left.

Professional units are usually made from 55 gallon metal drums with a heating element installed in the bottom to heat the water. The lid has a clamp that holds a metal mesh basket where you dump the dry ice. There is also a blower on the lid that blows air into the drum when the lid is clamped on. Dryer vent hose is attached to another hole on the lid and the air is forced out this way. When the metal basket is unclamped and lowered



into the water the heavy fog is generated and blown down the hose. These “Big boy” versions are really what is needed to give good ground coverage over a large area.

On a smaller scale, I have used a much simpler design for one Christmas program which had a skit with angels talking in heaven about Christmas. Before the program we simply filled two igloo drink dispensers (10 gallon, I think) with hot tap water about halfway. We prepared the dry ice (6 Lbs..) by breaking it up with a hammer to about ice-cube size. It breaks very easily. We placed the chunks in a towel. As the skit was to begin, we dumped the dry ice into the hot water and covered it loosely with the lids. The igloos were then carried on stage and partially covered with the white sheets we used for stage decoration. The fog bubbled out and flowed over the stage area (about 12' x 10') for over 5 minutes, but much more intensely at the beginning and less so as the water cooled. It worked quite well for that skit, and added significant "wow" factor to the production.

You need to be aware that as the fog is produced, it makes quite a loud bubbling sound. The igloos with their lids somewhat dampened it. The 5 Lbs... of dry ice would be the absolute minimum for this effect. Also, remember that the fog flows like water over surfaces. If you want a deep fog (like 1 foot deep or more) you have to either produce A LOT of fog, or try to contain it with something around the perimeter of the stage.

I have also made a small dry ice fogger that blows the fog through dryer vent hose. [see the accompanying illustration] I taped a 5" diameter computer muffin fan to the end of 6" diameter dryer vent hose and then taped the fan over a hole in a piece of cardboard 24" in diameter. Also note that the cardboard had another 3" diameter hole in it to allow air in. This cardboard/fan assembly was placed over the cooler after the dry ice was dumped into the water. It then blew the fog down the hose to the stage. This helps to keep the bubbling noise away from the stage. While my design was easy to make it doesn't have any control over the fog once you dump the dry ice in the water. For that you would need to first place the dry ice in a pourous container (a colander perhaps?) and then a means of slowly lowering it into the water and then locking it in place. Lifting the dry-ice partway out of the water will reduce the amount of fog, and taking it complete out of the water stop the effect.

OTHER IDEAS ON DRY-ICE FOG

Someone else also told me they have used a large coffee maker for their dry ice fogger, so they could keep the water heated. But even the large commercial units don't really use the heating element to keep the temperature up while the fog is being produced. They simply make it possible to heat a large amount of water to a high temperature, and then it takes a long time for it to cool.

I have also heard about a professional dry ice fogger that pumps the warm water over the dry ice, rather than immersing the dry ice in the water. This sounds like it could be home made and would allow you to turn the fog on and off with a remote switch. It may also be much quieter. But I haven't made one... yet.

I recently had a new idea, which I haven't tried out yet. (tell me if you do) It is to use an existing faucet to provide water to spray over the dry ice. Perhaps the dry ice can simply be placed in a backstage sink, and the faucet turned on to melt it. You might be able to convert a cheap Styrofoam cooler to use in the sink, and have the necessary fan and dryer vent attachment to direct the fog to the stage. It might be converted to a push-button operation by attaching an electric garden sprinkler valve to the water source.

Instead of purchasing dry ice before a show, you can purchase a dry ice generator for about \$100. It attaches to a CO₂ air tank and when you open the valve, dry ice is produced in it. I am told it is about 20% efficient... every 5 Lbs... of gas used produces 1 lb of solid. Not bad actually, and saves the trouble of having to go out to buy the dry ice for every performance. It makes it more viable to incorporate it in your traveling show - especially for smaller quantities so you don't have to keep looking for a dry ice source. Also, I think Edmund Scientific carries a smaller version for less money - great for the traveling mad scientist.

An important safety consideration is that you must have Oxygen to breath. If you fill a box containing a person with dry ice fog (really CO₂ gas) - they will not be able to breath because the heavier CO₂ has displaced all the O₂. An orchestra pit is another possible heavy fog collector. But in my experiences, simply rolling about in it on stage and breathing the fog is not a problem.

I think 25 Lbs.. of dry ice is the minimum you should start with when wanting to do a full sized stage for just a few moments of fog. A person would really have to purchase some and just try it to get a feel for how much dry ice and hot water is needed for the effect they want. The 25 lbs.. really is just a start, and you may realize you need much more to get the effect you desire.

There have been alternatives developed to make the heavy fog at a lower cost. . .

I have also heard of "chillers" that take the output of a regular glycol based fog machine and cools it so that it stays near the ground. the professional ones are quite expensive. I have played with pumping the fog through an aluminum duct that is coiled in an ice chest

filled with ice. The fog is then cooled as it goes through the aluminum tubing. It kind of works, but not extremely well -and the fog rises up into the air as it warms up.

Another approach adds CO₂ gas directly to the output of a regular glycol fogger. It simply has a solenoid valve that opens when the fog is being sprayed out and mixes the CO₂ with the fog. I have not seen the results, but it should also tend to rise as the CO₂ mixes with the regular air. I have also been told that this is extremely noisy because of the sound of the gas escaping from the tank. This is another project that I want to experiment with someday to see if I can make it myself.

Finally, I think I have found the best solution. I placed a fairly small amount of dry ice (5 lbs.) in a box (cardboard will work, but water will eventually condense from the cold, and make it soggy). Then the output of a glycol fogger is directed into the box where it melts the dry ice a bit, and mixes with the CO₂ gas. The fog is also cooled as it flows over the dry ice. It also helps to have a metal grill shelf suspended halfway up the box so some of the dry ice can be suspended in the air - this is just to increase the surface area exposed to the fog. The results are MUCH better than just using water ice, which I have also tried. Still, the fog will eventually rise and disperse in the air, but it allows you to product much more of the heavy fog with only a small amount of dry ice. I have been told that commercial versions of these "chillers" will use a special fog formula which is designed to disappear more quickly than the regular fog juice. That sounds like a good idea, but I haven't tried it yet.

A similar design to hose/fan assembly I have illustrated here can be used with glycol foggers to keep the hissing sound off stage. Just put the hose/fan assembly on a cardboard box and point the output nozzle from a glycol fogger into another hole in the box. The fog will then be directed through the hose.

CONCLUDING REMARKS

And now some concluding advice for special effects... It is easy to delude yourself and do special effects and say it adds a lot to the drama, while your real motivation was that it is fun. Fun can be a valid reason to add special effects. My angels didn't need the heavy fog to do the skit they learned - but it did get a lot of "Oooo"s from the audience. People talked about it for weeks.

However, if the skit were to have been a somber one, the fog might have detracted from that mood in my setting. So, don't delude yourself into thinking that effects equal good theater. Also, some special effects can cost a lot of money, or a lot of time to do. So, ask yourself if it is worth it. I have found that the addition of just one "Oooo" effect makes the audience feel it was a special performance. It may be a cheap gimmick (well, not necessarily cheap) but people like it anyway. Doing an effect just because you have fun with it, is certainly a valid reason - as long as you realize that fun is your purpose.