



Technique...

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Whistle Rocket Fuel in Under 8 Hours

by *Robert D. (Dan) McMurray*



From top to bottom, left to right: Nitrile chemical gloves, spatulas (large and small), 58-quart storage container, AOSafety breathing respirator, 1-gallon HDPE bucket, 20 mesh target sieve, HDPE tumbler, 500 cc HDPE measuring cup, 1-gallon HDPE bucket, 30 mesh Wal-Mart sieve, 16 quart sauce pot, 8 quart stainless steel bowl.

Introduction:

The method of making whistle mix shown here allows about 4 kilograms (around 10 pounds) of fuel to be prepared and ready for use in less than 8 hours. To improve fuel quality and decrease preparation time, this recipe uses Naphtha (e.g., Camping Fuel, VM&P Naphtha, or Mineral Spirits) to dissolve the Petroleum Jelly (e.g., Vaseline.) instead of Acetone or Toluene. Naphtha solvent minimizes moisture accumulation while drying and eliminates the need to crush and/or screen the dried fuel.

Equipment List:

- ▶ Safety glasses.
- ▶ Chemical gloves suitable for handling Naphtha solvents. The "Performance Plus. Refinishing Gloves" in Nitrile or Neoprene are sold by Home Depot for about \$4.00 and work well in this application.
- ▶ Breathing respirator suitable for working with organic paint solvents.
- ▶ Scale suitable for weighing chemicals.
- ▶ Two screens: one 20-mesh and one 40-mesh. Usable substitutes are available at Target and Wal-Mart in the Housewares section. An 8.5" (outside diameter) plastic framed strainer with a stainless steel screen from Target for about \$7.00 will substitute for the 20-mesh screen. A 6.5" (inside dimension) all-stainless steel strainer with the name "SoftSides" on the handle and about a 30-mesh screen from Wal-Mart for about \$7.00 will substitute for the 40-mesh screen.
- ▶ One stainless steel mixing bowl to withstand Naphtha solvent and hot water. An 8-quart stainless steel mixing bowl by Metro (Item No. 0065) available at Wal-Mart for about \$5.00 is ideal for this purpose. This bowl is large enough to make a 4 kilogram (about 10 pounds) batch of fuel.
- ▶ Two plastic containers of one-gallon capacity or larger. To contain screening dust, screens should fit tightly onto these containers. The one-gallon high-density polyethylene bucket with 7" I.D. top made by Encore Plastics Corporation and available in the Paint department of Lowe's Home Improvement Store for about \$2.00 work well with the screens mentioned above.
- ▶ A 500 to 1500 milliliter (e.g., a Pyrex beaker, plastic measuring cup, plastic tumbler) for measuring Naphtha, melting the Petroleum Jelly, and mixing the Naphtha with the Petroleum Jelly.
- ▶ Small pan suitable for heating about 2 quarts of water to warm the Naphtha and melt the Petroleum Jelly.

- ▶ **Optional:** Ball mill with two containers and two sets of media: one for fuel/catalyst and one for oxidizer
- ▶ **Optional:** A large pan suitable for heating enough water to "float" the stainless steel mixing bowl, but small enough to keep the bowl from turning over. A good combination of stainless mixing bowl and large pan is available at Wal-Mart. The 8-quart stainless steel bowl identified above fits well into a 16-quart Teflon coated aluminum sauce pot by Mirro (Mfg. No. 34018) that costs about \$25.00. Less expensive 16-quart sauce pots that fit the bowl are available.
- ▶ **Optional:** A container large enough to hold all of the equipment described above. A 58-quart Sterilite storage container is available from Home Depot, Lowe's Home Improvement Store, Wal-Mart and most discount department stores for under \$5.00.

Ingredients for 76/23/1+3 Sodium Salicylate Whistle Fuel

Ingredient	Small Batch (1/4 pound)	Large Batch (10 pounds)
Potassium Perchlorate (K Cl O ₄) (oxidizer)	76 grams	3040 grams
Sodium Salicylate (Na C ₇ H ₅ O ₃) (fuel)	23 grams	920 grams
Red Iron Oxide (Fe ₂ O ₃) (catalyst)	1 grams	40 grams
Petroleum Jelly (stabilizer)	3 grams	120 grams
Naphtha (Petroleum Jelly solvent)	25 milliliters	1000 milliliters

NOTE: Potassium Perchlorate, Sodium Salicylate, and Red Iron Oxide must be air float powders.

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Solvent Comments:

Chemically, Acetone and Toluene are classified as "polar solvents". Acetone poses an extreme flammability hazard and a minimal health hazard. Toluene poses a severe flammability hazard and a moderate health hazard. Both evaporate rapidly; however, Acetone evaporates much faster than Toluene. Acetone mixes with water in any proportions, while only a trace amount of Toluene will mix with water.

Camping Fuel, VM&P Naphtha, and Mineral Spirits are all classified as "non-polar solvents". All are flammable; however, Camping Fuel represents an extreme flammability hazard while VM&P Naphtha and Mineral Spirits represent severe and moderate flammability hazards, respectively. All evaporate rapidly, with Camping Fuel evaporating by far the fastest and Mineral Spirits evaporating the slowest. All of these solvents pose a minimal health hazard. These solvents do not mix with water.

Sodium Salicylate is classified as a "polar reactant". Sodium Salicylate is declumped and slightly dissolved by Acetone or Toluene. Although Acetone and Toluene are not good Sodium Salicylate solvents, hard clumps form when these solvents evaporate from a Sodium Salicylate/solvent mixture. Camping Fuel, VM&P Naphtha, and Mineral Spirits do not declump or dissolve Sodium Salicylate. Hard clumps do not form when these solvents evaporate from a Sodium Salicylate/solvent mixture.

Petroleum Jelly is classified as a "non-polar reactant". Camping Fuel, VM&P Naphtha, and Mineral Spirits are excellent Petroleum Jelly solvents. Acetone and Toluene are poor Petroleum Jelly solvents.

Potassium Perchlorate and Red Iron Oxide are not soluble in Acetone, Toluene, Camping Fuel, VM&P Naphtha, or Mineral Spirits. Potassium Perchlorate and Red Iron Oxide declump in these solvents to a powder having the milled particle size.

Camping Fuel is inexpensive, readily available and very flammable, but less flammable than Acetone. VM&P Naphtha and Mineral Spirits are also readily available, but are less flammable than Camping Fuel, Acetone, or Toluene. VM&P Naphtha and Mineral Spirits are more expensive than Camping Fuel, but less expensive than Acetone or Toluene. Camping Fuel for portable stoves and lanterns is available in the Sporting Goods section of most discount department stores like Wal-Mart or K-Mart. VM&P Naphtha and Mineral Spirits are available in the PAINT section at Home Depot and most hardware stores.

Solvent	Health Hazard (NFPA)	Fire Hazard (NFPA)	Mixes with Water	Evaporation Rate (n-Butyl Acetate=1)	Sodium Salicylate (Note 1)	Potassium Perchlorate (Note 1)	Red Iron Oxide (Note 1)
Acetone	1	4	Yes	5.6	D,5	D,0	D,0
Camping Fuel	1	4	No	2.7	A,0	D,0	D,0
Toluene	2	3	0.05%	2.4	D,3	D,0	D,0
VM&P Naphtha	1	3	No	1.4	A,0	D,0	D,0
Mineral Spirits	0	2	No	0.1	A,0	D,0	D,0
Water	----	----	----	0.3	N/A	N/A	N/A

NOTE 1:

Declumping Index: A - does not declump, D - declumps to powder

Solvent Index: 0 - not a solvent, 3 - poor solvent, 5 - slight solvent

NFPA Hazard Rating:

0 - None, 1 - Slight, 2 - Moderate, 3 - Severe, 4 - Extreme

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Figure 1: Screening potassium perchlorate individually into a plastic container.

Procedure:

- 1) Using the scale, weigh out the Sodium Salicylate and Red Iron Oxide into the stainless mixing bowl.

Using the scale, weigh out the Potassium Perchlorate into a plastic container.

Using the scale, weigh out the required amount of Petroleum Jelly into the melting container.

NOTE: If possible, the Potassium Perchlorate, Sodium Salicylate, and Red Iron Oxide should be purchased as very fine or "air float" powders. If this is not possible, milling is required. Naphtha declumps finely powdered Red Iron Oxide or Potassium Perchlorate. Sodium Salicylate clumps must be eliminated by milling, screening, and/or adding a declumping agent.

WARNING: Do not screen, stir, or ball mill dry Potassium Perchlorate mixed with Sodium Salicylate. The dry mixture of Potassium Perchlorate and Sodium Salicylate is very static, shock, and friction sensitive. THE DRY MIXTURE IS EXPLOSIVE!!

Optional: To increase burning speed: Both the Sodium Salicylate & Red Iron Oxide mixture and the Potassium Perchlorate may be ball milled. In both cases, 8 hours of ball milling should be long enough. While being ball milled, the Sodium Salicylate & Red Iron Oxide mixture without a declumping agent will have to be broken-up periodically because it has a tendency to stick to the sides of the ball mill.

WARNING: The Sodium Salicylate & Red Iron Oxide mixture (i.e., fuel & catalyst) must be ball milled in a different container and with different media from the container and media used to ball mill the Potassium Perchlorate (i.e., oxidizer).



Figure 2: Stirring and drying the mixed composition over hot water.



Figure 3: Screening the dried composition.



Figure 4: Dried and screened fuel ready for storage.

- 2) Fill the small pan with enough water to almost "float" the Petroleum Jelly melting container. Place the container of Petroleum Jelly into the water. Heat the pan, water, and Petroleum Jelly melting container until the Petroleum Jelly is a liquid. If the final mixture will be dried using the optional large pan of hot water, the large pan of water should be put on to heat at this time.

FOR THE REMAINING STEPS, WEAR SAFETY GLASSES, CHEMICAL GLOVES, AND A BREATHING RESPIRATOR FOR USE WITH ORGANIC SOLVENTS. REMOVE ALL HAND JEWELRY, WATCHES, AND BELT BUCKLES. OTHER THAN THE STAINLESS STEEL MIXING BOWL AND WATER POT, MAKE SURE THERE ARE NO METAL OBJECTS IN THE WORK AREA.

WARNING (!!!): GO OUT OF DOORS, DO NOT PERFORM THE FOLLOWING STEPS INSIDE. STAY AWAY FROM OPEN FLAMES, SPARKS, OR OTHER POSSIBLE IGNITION SOURCES. NAPHTHA VAPORS ARE FLAMMABLE.

WARNING (!!!): DO NOT PERFORM THE FOLLOWING STEPS IN DIRECT SUNLIGHT. THE STAINLESS STEEL MIXING BOWL CAN FOCUS THE SUNLIGHT AND IGNITE THE MIXTURE.

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- 3) Using a clean plastic container, screen the Sodium Salicylate & Red Iron Oxide mixture through the 20-mesh screen. Place the screened result back into the stainless mixing bowl.
- 4) Using a clean plastic container, screen the Potassium Perchlorate through the 40-mesh screen. Place the screened result into a plastic container.
- 5) If the Petroleum Jelly melting container is made of glass, make sure the Petroleum Jelly melting container is cool enough to keep from breaking when cold Naphtha is added.
- 6) Measure and pour about half of the required amount of Naphtha into the container with the melted Petroleum Jelly. Shake, stir, and/or warm the container IN HOT WATER, AWAY FROM IGNITION SOURCES, until the Petroleum Jelly dissolves in the Naphtha.
- 7) Pour the Naphtha & Petroleum Jelly mixture into the stainless mixing bowl with the Sodium Salicylate & Red Iron Oxide. Pour the rest of the required amount of Naphtha into the Petroleum Jelly melting container, swirl it around to rinse off the Petroleum Jelly residue, and add the rinse to the mix.
- 8) Using one gloved hand only, distribute the Naphtha & Petroleum Jelly mixture throughout the Sodium Salicylate & Red Iron Oxide. Scoop up the mixture, a hand full at a time, and squeeze it through your fingers until no dry powder is present in the bowl. Continue until the mixture looks like smooth tomato soup - no lumps.
- 9) Using your clean gloved hand, pour all of the Potassium Perchlorate into the stainless mixing bowl. NOTE: Adding Naphtha & Petroleum Jelly to the Sodium Salicylate & Red Iron Oxide before adding the Potassium Perchlorate "wets" and stabilizes the mixture, making it much safer to handle.
- 10) Using both gloved hands, combine the ingredients. Scoop up hands full of the mixture and squeeze it through your fingers until the ingredients are completely mixed. This step typically takes 5 minutes. The resulting wet mixture should be smooth and a uniform dark red color.
- 11) Remove as much of the mixture as possible from your gloves into the bowl. At this time, your gloves may be removed and set aside to dry. Most of the dry fuel can be recovered by flexing the glove material over the mixing bowl.

Using a soft plastic spatula, scrape the sides and bottom of the bowl, stir the mixture, and re-spread the mixture on the sides of the bowl. Repeat every 15 to 20 minutes until the mixture is dry and powdered.

Optional: To reduce drying time, fill the large pan with enough water to "float" the stainless mixing bowl, heat the pan of water until it boils, remove the pan of boiling water from the heat, and take it outside. Float the stainless steel bowl of wet mixture in the pan of hot water. To reduce effort and frustration, "lock" the bowl into the large pan.

NOTE: Using 1/16" stainless steel or brass welding rod, wire locks can be fabricated to secure the stainless steel mixing bowl into the top of the 16-quart sauce pot via the handles (see picture). This addition creates a tight bowl-

to-pot seal and stabilizes the bowl in the water filled pot to make scraping, stirring, and spreading the mixture a lot easier.

WARNING: USE ONLY HOT WATER IN OPEN AIR TO DRY THE MIXTURE. DO NOT USE A CAMP STOVE, ELECTRIC HOT PLATE, OR ANY OTHER HEAT SOURCE THAT CAN POTENTIALLY IGNITE THE FLAMMABLE VAPORS PRODUCED DURING THE DRYING OPERATION.

Using a soft plastic spatula, scrape the sides and bottom of the bowl, stir the mixture, and re-spread the mixture on the heated sides of the bowl. Repeat until the solvent evaporates out of the mixture. When most of the liquid solvent evaporates from a large batch, final drying may be accomplished in smaller batches. The smaller the batch and the more often the mixture is scraped, stirred, and spread on the heated sides of the bowl, the less time required for drying.

12) If required, carefully screen the dried mixture through the 20-mesh screen using a soft plastic spatula.

When completely dry, the properly combined mixture is soft, fluffy, and powdered. Any lumps are small, soft, and crumble easily between a soft spatula and the side of the bowl. Except for special applications, (as in fuel to be used in small rockets) the dry, properly combined mixture should not need screening.

13) Inspect the dried fuel for white granules among the red. The presence of white granules indicates that the ingredients were incompletely mixed in Steps 8 and 10. The correction is to thoroughly "wet" the mixture with Naphtha and repeat Steps 10, 11, 12, and 13.

14) When complete, properly store the resulting powder.

WARNING: At this point, the mixture is still sensitive to static, shock, and friction (although the Petroleum Jelly has helped stabilize and desensitize the mix). 🔥

HANDLE AND STORE WHISTLE ROCKET FUEL AS YOU WOULD FLASH!

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