

"OBSERVE ENVIRONMENT FRIENDLY DEEPAWALI"

Crackers spoil our environment by causing noise and air pollution and adversely affect health. The Fireworks emit pollution and adversely affect health. The fireworks emit smoke, fine toxic dust and chemicals that can cause the following problems:

- (i) Aggravation of respiratory diseases
- (ii) Injury to the eyes and other parts of the body
- (iii) Impairment of hearing capacity
- (iv) Insomnia, hypertension, stress, palpitation etc
- (v) Distress to the animals including pets

The Uttar Pradesh Pollution Control Board request the people to celebrate the festival of Deepawali with care for life and concern for environment.



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Chemistry of Fireworks

The Petroleum and Explosive Safety Organization (PESO) categorized four types of commonly used sound producing fire crackers namely (a) Atom Bomb, (b) Chinese Crackers (not related to any country), (c) Maroons & (d) Garland crackers.

The Chemistry of fireworks is based on combustive features of the ingredients used and the lighting effects that are generated after their burning. Following are key ingredients:

- I. **Fuel:** Charcoal i.e. black powder is the most common fuel used in fireworks.
- II. **Oxidizing Agents:** The function of the oxidizing agent is to produce the oxygen needed in order to burn the mixture within the fireworks.
- III. **Reducing Agents:** It needs to burn oxygen provided by the oxidizing agents.
- IV. **Regulators:** Metals can be added to regulate the speed of the reaction and colorings agents.
- V. **Binders:** Binders are used to hold the mixture of the firework together in a paste like mixture.
- VI. **Colorings agents:** Different chemicals are used to produce colored fireworks.



HEALTH HAZARDS OF CHEMICALS AND METALS PRESENT IN FIRECRACKERS



	Initial ingredient	Reaction	Final compound	Colour		Health effects
Fuel 	Charcoal Charcoal+ Potassium nitrate+ Sulphur= Black Powder	$C+O_2=CO_2$ $KNO_3=KNO_2+NO$ $S+O_2=SO_2$	CO_2 NO_2+NO_3 (unburnt) SO_2	-		Toxic dust, carcinogenic sulphur-coal compound
	Aluminium	$Metallic\ Al+O_2=Al_2O_3$	Produces brilliant flames and white sparks	Contact dermatitis, bioaccumulation		
Coloring Agents 	Strontium+Lithium	Metallic Nitrate=metal oxides+NO+Unburnt metals Metallic Carbonate=metal oxides+CO+CO ₂ +Unburnt metals	Strontium salts, lithium salts lithium carbonate, Li ₂ CO ₃ =red strontium carbonate, SrCO ₃ =bright red bright Red	Red		Strontium: can replace calcium in body. strontium chloride is slightly toxic. Lithium: Toxic & irritating fumes when burned.
	Calcium	Metallic chloride=metal oxides+Cl ₂ +Unburnt metals	Calcium salts Calcium chloride, CaCl ₂	Orange		
	Barium		Barium Compound+Chlorine producer Barium chloride, BaCl ₂		Green	

	Copper		Copper Compound+Chlorine producer Copper(i)chloride, CuCl	Blue		Copper: Polychlorinated dioxins and dibenzofurans. Can bio-accumulate. Cancer risk.
	sodium		Sodium salts sodium chloride, NaCl	Yellow		
	Strontium+ Copper		Mixtute of strontium(red) and copper (blue) compounds	purple		Strontium: can replace calcium in body. strontium chloride is slightly toxic. Copper: Polychlorinated dioxins and dibenzofurans. Can bio-accumulate. Cancer risk.
	Aluminium		Burning aluminium, titanium, or magnesium	silver		Aluminium: Contact dermatitis, bioaccumulation
Oxidizing agents 	Nitrates	$XNO_3 = XNO_2 + 1/2 O_2$ $2XClO_3 = 2XCl + 3O_2$	Chloride			Bio-accumulation, developmental danger for kids & unborn babies, many remains airborne for days, poisonous to plants & animals
	Chlorates or perchlorates	$XClO_4 = XCl + 2O_2$	Chloride/Nitrates			Bio-accumulation, developmental danger for kids & unborn babies, many remains airborne for days, poisonous to plants & animals
Reducing agents	Sulphur	$S + O_2 = SO$	Sulphur dioxide (SO ₂)			acid rain from sulphuric acid affects water sources, vegetation & causes property damage
Binders	Dextrin Glue, paper	Organic emission: Glycogen Glucogen=CO ₂ +H ₂ +Unburnt	Ash, VOCs, CO, PAHs			Eye, nose, and throat irritation, headaches, loss of coordination, nausea: and damage to the liver, kidney, and central nervous system, carcinogenic