IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# "CONTROL OF DUST ON ROADWAY USING CALCIUM CHLORIDE"

**Mr. Yashraj Pawar, Mr. Dhiraj Shinde, Ms. Vishal Waghmare, Mr Rohan Jawale, Mr Vaibhav Sawant**

**Prof. N.A. Autade**

**B.E Civil (Department of Civil Engineering)**

UG Student, Department of Civil Engineering, Trnity College of Engineering, Pune

Assistant Professor, Department of Civil Engineering, Trnity College of Engineering, Pune

***Abstract*—** This paper represents the quality of the gravel used in road construction has a profound positive impact on road service life. The potential use of calcium chloride as a dust control agent and material for stabilizing the base of unpaved roads has been researched. However, the quality of the gravel may be impacted if calcium chloride is introduced as a dust suppressant into it. The main aim of this research is to examine the increase in strength of soil specimens treated with calcium chloride and to evaluate how different proportions of calcium chloride as a dust suppressant and base stabilizer affect the California Bearing Ratio value of the soil samples. Mixtures of natural gravel and gravel with varying amounts of calcium chloride were analyzed for their Atterberg limits, grading, maximum dry density, CBR properties, and optimum moisture content. The changes in the characteristics of the gravel -calcium chloride mixtures were analyzed. It was found that the particle size distribution and Atterberg limits remained largely unchanged. However, the optimum moisture content (OMC) decreased from 9.2% to 7.6%, 7.4%, and 7.2% with calcium chloride added at percentages of2 percent, 3 percent, and4 percent per volume of dry soil, respectively. Observation of the mixture revealed an increase in the maximum dry density (MDD) as the ratios of calcium chloride were altered. The maximum dry density significantly increased from 2.15 Mg/m3to 2.31 Mg/m3, 2.35Mg/m3, and 2.36Mg/m3, respectively. Along with this, the California Bearing Ratio (CBR) demonstrated an improvement of 25% to 29%, 32%, and 36% at 95% compaction with an increase in the ratios of calcium chloride. The increase in dry density can be explained by the improved bonding between particles and the reduction of air voids. This increase in dry density, in turn, positively influences the California Bearing Ratio by transforming soil structure from a dispersed state to a flocculated state. It can be inferred from the results that calcium chloride has the potential to function as a stabilizer for unpaved roads. The findings of this study are expected to reduced life cycle costs for unpaved roads, provide insights for the best approach to materials analysis for unpaved roads, and contribute to environmental benefits by minimizingdust emissions into the atmosphere and reducing the release of chemicals into nature.

***Keywords—Dust Control, Calcium chloride, Dust Analysis, Health, Air Pollution***

## INTRODUCTION

The contribution of road dust to the city's overall pollution load has more than doubled over the past decade, reveals the interim results from a source apportionment study conducted by the National Environmental Engineering Research Institute (NEERI).

Road dust largely refers to solid particles generated during the handling and processing of road-building materials, such as gravel and concrete. Turbulence generated by passing traffic, particularly in areas with high traffic volume, or where road surface erosion and tyre wear are high, also generates and

resuspends fugitive particles which become airborne. Preliminary findings from NEERI's study indicate that such pollutants make up 71% of all particulate matter pollution in Mumbai. Of this, 45% comes from unpaved roads (which are more prone to erosion by wind) followed by paved surfaces, which contribute to 26% of the city's dust load. Another 8% comes from particulate matter emissions traced to construction activities, and 3% to vehicles. The rest comes from industries, the domestic sector, aircraft, marine vessels, open eateries, bakeries, and crematoria.

Road dust consists of solid particles that are generated by any mechanical processing of materials, including crushing, grinding, rapid impact, handling, detonation, and decrepitation of organic and inorganic materials such as rock, ore, and metal. When this dust becomes airborne, primarily by the friction of tires moving on unpaved dirt roads and dust-covered paved roads, it is referred to as road dust

Dust is a nuisance. Fugitive dust pollutes the air we breathe and contaminates our land and water resources. It is harmful to human health and safety, has a negative impact on the growth of plants, insects and animals both on land and in water.

Dust can also negatively affect the economy of companies as excess exposure to it can result in productivity loss, sick leave and operational downtime.

Human activities that generate dust are a real concern today. Gravel roads, mining, broadacre, agriculture, recreation, industry and stockpiles can all generate significant amounts of dust, which can have serious consequences if left uncontrolled.

Dust control or dust management is often never-ending, requiring a commitment and investment of both time and money.

**Problem Statement**

Inhaling fine dust particles can be a health hazard to road users and residents. Respiratory problems resulting from the thousands of particulates that fill the air in the aftermath of unpaved road traffic has become an important health concern. Although wind erosion and various types of construction activities generate dust in the lower atmosphere, road dust causes a concentration of air pollution that can directly affect people who live within close proximity to an unpaved roadway.

Some health experts even believe that chronic bronchitis and irregular heartbeat can result from exposure to particle pollution, and premature death is possible if individuals already suffer from lung or heart disease

**Aim**

"To find economic way of controlling dust on roadway using calcium chloride."

**Objectives**

- To study health effect due to dust
- To study economic loss due to dust
- To measure the effect of vehicle speed on emissions
- To determine the concentration and size distribution of traffic generated dust
- To study control of dust
- To study environmental benefit of dust control

**RESEARCH METHODOLOGY**

**The Methods of Controlling Dust on Roadway using Calcium Chloride**

Controlling dust on roadways using calcium chloride is a common practice in many regions. Calcium chloride is a hygroscopic compound that attracts moisture from the air, helping to suppress dust by keeping the road surface damp. Here's a methodology for using calcium chloride to control dust on roadways.

- **Assess the road conditions**: Determine the extent of dust-related issues on the roadway. Factors such as traffic volume, climate, soil composition, and road surface condition should be considered.

- **Calculate the required amount of calcium chloride**: The application rate depends on several factors, including the desired level of dust control, road conditions, and the type of calcium chloride product being

used. Consult with a local expert or a calcium chloride supplier to determine the appropriate dosage.

- **Prepare the roadway**: Before applying calcium chloride, it is important to prepare the roadway. Remove debris, loose gravel, and other obstacles that may interfere with the treatment. Patch any potholes or cracks to ensure a smooth surface.

- **Safety precautions**: Wear appropriate personal protective equipment (PPE) such as gloves, safety goggles, and a dust mask. Calcium chloride can be corrosive, so take precautions to avoid skin and eye contact. Follow all safety guidelines and instructions provided by the calcium chloride manufacturer.

- **Apply calcium chloride**: There are different methods for applying calcium chloride, including spraying, spreading, and mixing it with the road surface. The specific application method will depend on the road conditions, equipment availability, and budget constraints.

- **Spraying:** Use a water truck equipped with spray nozzles to evenly distribute a calcium chloride solution on the road surface. Adjust the nozzle settings to achieve the desired coverage.

- **Spreading**: Spread solid calcium chloride pellets or flakes directly onto the road using a spreader truck or equipment designed for this purpose. Ensure even distribution to maximize effectiveness.

- **Mixing**: For smaller roads or localized dust control, calcium chloride can be mixed into the road surface. This method requires specialized equipment and expertise.

- **Monitor and maintain**: Regularly monitor the road conditions and the effectiveness of the calcium chloride treatment. Adjust the application rate or frequency as needed. Reapply calcium chloride, when necessary, typically after rainfall or if dust problems reoccur.

It's important to note that the exact methodology may vary depending on regional practices, road conditions, and local regulations. Consulting with local road maintenance authorities or experts in your area will provide the most accurate guidance for using calcium chloride to control dust on roadways.

**Calcium Chloride for Dust Control**

Calcium chloride pellets are hygroscopic which means they attract moisture from the air and their surroundings. This property is how calcium chloride keeps the road's surface damp which, in turn, helps keep the dust down. It also resists evaporation, which allows one application to last a long period of time, even on the hottest and driest of days.
Choosing between liquid or dry calcium chloride can be difficult, but it is usually based on economic considerations in addition to the type of storage, mixing, and available application equipment. In most cases, liquid calcium chloride is preferred as it has a more even chemical distribution. •This product can be purchased in a 32%-38% solution or users can mix solid calcium chloride pellets with water to produce a liquid. In the case that you want to spread the calcium chloride directly onto the unpaved surface without first putting it into a solution, you should add water to the unpaved surface beforehand. •Aim to treat unpaved surfaces with calcium chloride in the spring after seasonal rains, when moisture is still on the ground. Avoid starting applications when it is raining heavily or if rain is in the forecast.

**How to Make Liquid Calcium Chloride for Dust Control**

To make the liquid mixture, measure 42 ounces of anhydrous calcium chloride pellets into a plastic bowl and transfer them to an empty 1-gallon jug with a funnel. Then, fill the plastic container roughly halfway with tap water, being careful not to spill the contents in the process. Swirl the container in a circular motion until the pellets have fully dissolved, a process that could take several minutes. Fill the gallon container to full capacity and tightly put on the cap and turn the jug over three times to fully mix the contents. Make sure to clearly label the containers.

**How Do You Apply Calcium Chloride for Dust Control?**

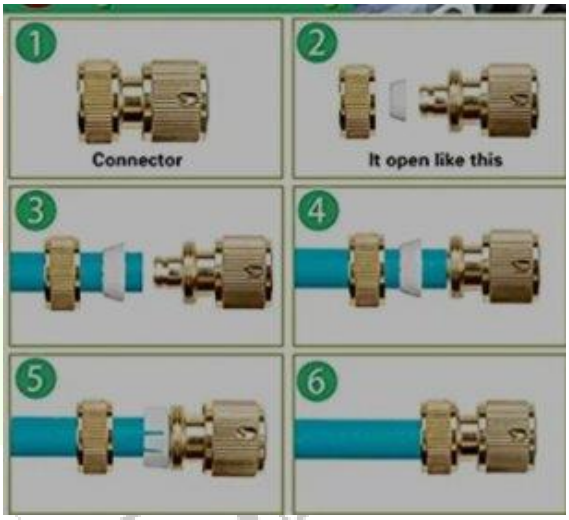
You can add calcium chloride to the surface of a road during or after blading and shaping at any time throughout the year. For best results, apply the calcium chloride in the spring when the road still has some moisture from the rains. In terms of maintenance, you should add new aggregate and fines while blending and shaping the road surface into the proper crown. In most cases, a straight-line crown of 0.5 inches per foot is the most satisfactory. Make sure that the borrow ditches are shaped for good drainage as standing water could result in potholes or road base failures.

You can use ordinary lime drill spreaders, tailgate spreaders, or basic disc spreaders when applying the flakes or pellets. If you're using liquid calcium chloride, you should use tanker trucks with spray bars. Whatever the equipment that you use, make sure that you clean it afterward to prevent residue from accumulating.

In terms of how much calcium chloride to distribute, most manufacturers recommend application rates from 1-1.5 pounds of flake per square yard for newly treated roads or 0.5 to 1 pound per square yard for roads that were previously treated

METHOS

- First of all, take a nozzle spray and fit it on the mover.
- This nozzle spray mover should be rotate horizontally.
- Take the nozzle with mover and fit it and join the PVC pipe to it.
- joined PVC pipe hydraulic compressor and HP motor.
- Then join the wire of motor and hydraulic compressor.
- Assemble the dust protector.
- Then dust protector to use




## CONCLUSION

1) Controlling dust prevents fine particles from getting into the air, damaging crops and vegetation and causing health problems.
2) Dust suppressants attract moisture from the air that binds fine particles and aggregates, keeping roads durable, rugged, smooth and safe.
3) This increases the likelihood of loss of vehicle control and collisions.

**Estimated Budget for 1KM Roadway Dust Control using calcium chloride**

| Name | Quantity | Price (Rs.) | Amount (Rs.) |
|---|---|---|---|
| Motor (5 hp) | 1 | 12,000 | 12,000 |
| PVC Pipe | 328 | 90 | 32,000 |
| Joints | 260 | 20 | 5200 |
| Calcium chloride | 20 | 250 | 5000 |
| Nozzle | 100 | 150 | 15,000 |

**Total Amount for 1KM Roadway - 70,000 Rs.**
**Amount of water required for a single of use – 10 liters**
**Approximate Cost of Electricity for a single day use – 15 Rs.**

Amount of money and resources will reduce further the distance increases.

## REFERENCES


[1]. Kentucky Division of Air Quality Fugitive dust. [cited 2018 Apr 23].
[2]. Potgieter-Vermaak S, Rotondo G, Novakovic V, Rollins S, Van Grekin R. Component-specific toxic concerns of the inhalable fraction of urban road dust. *Environ Geochem Health.* 2012; 34:689–696.
[3]. Gatto MP, Garozzo C, Gordian A, L'Episcopo N, Gherardi M. Children and elders' exposure assessment to particle-bound polycyclic aromatic hydrocarbons (PAHs) in the city of Rome, Italy. *Environ Sci Pollut Res Int.* 2014; 21:13152–13159
[4]. Lorenzi D, Entwistle JA, Cave M, Dean JR. Determination of polycyclic aromatic hydrocarbons in urban street dust: implications for human health. *Chemosphere.* 2011; 83:970–977.
[5]. Margaret Buranen Studies in Dust Control June 20, 2017
[6]. Ducret-Stich RE, Tsai MY, Thimmaiah D, Künzli N, Hopke PK, Phuleria HC. PM10 source apportionment in a Swiss Alpine valley impacted by highway traffic. *Environ Sci Pollute Res Int.* 2013; 20:6496–6508.
[7]. Faiz Y, Siddique N, Tufail M. Pollution level and health risk assessment of road dust from an expressway. *J Environ Sci Health A Tox Hazard Subs Environ Eng.* 2012;47:818–829
[8]. A. Christoforidis and N.. Stamatis, Heavy metal contamination in street dust and roadside soil along the major national road in Kavala's region. Greece, *151* (2009) 257–263.
[9]. H. Adedeji Oludare, O. Olayinka Oluwafunmilayo and F. Oyebanji Felica, Assessment of traffic related heavy metals pollution of roadside soils in emerging urban centres in Ijebu-North Area of Ogun State. Nigeria, Journal of Applied Sciences and Environmental Management, *17* (2013) 509–514.
[10]. R. Mathur, V. Balaram, M. Satyanarayanan and S. S. Sawant, Assessment of heavy metal contamination of road dusts from industrial areas of Hyderabad, India; Environmental Monititoring and Assessessment, 188(514) 2016.