

## NEEM OIL & NEEM COATED UREA

### Author

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### Introduction

National Fertilizers Limited (NFL), one of the premier manufacturers of nitrogenous fertilisers in the country, has developed a process for production of Neem-coated urea on commercial scale.

The extensive laboratory and field studies have shown that the new product produced with a thin film of Neem oil-water emulsion of specified concentration would increase the shelf life of product.

"It will reduce caking during storage and also improve availability of nitrogen to crops at the time of growth. It will also result in better crop yield". The price of Neem-coated urea will be marginally higher than the cost of normal urea. The results obtained under the general parameters have shown an increase in crop yield and efficient pest control management with an average saving. The process will help in harnessing unique properties of Neem for regulating release of nitrogen to crops when mixed and applied with urea into soil and making available to farmers a more efficient nitrogenous fertilisers based upon the research work conducted by scientists of Indian Agriculture Research Institute, New Delhi. Urea can be used in an effective manner. Smaller quantities of urea can be more effective than normal quantities being used by farmers currently. This will especially help the paddy crop in low land conditions," During the on going Rabi season, the company proposes to have more field demonstrations for crops like sugarcane, potato and wheat with reduced doses of nitrogen to extent of 80 per cent through Neem coated urea as compared to full recommended dose through normal urea to establish benefits accruing in terms of increased productivity.

Neem oil or Margosa oil is botanical oil extracted from kernel of Neem tree seed by Cold Pressing or CT Cold Pressing method or Solvent Extraction. Among these methods CT cold pressing yield purest Neem oil because solvent is not used for extraction.

### Properties of Neem Oil

Neem Oil or Neem Seed Oil is a Brownish Yellow color Liquid, with smell of Garlic. Neem Oil is slightly soluble in water and has 6.5 to 7.5 pH value; it boils at more than 200 °C and freeze at 13 °C.

Moisture	= 0.2% Max.
Specific gravity	= 0.94 at 30 °C
Iodine Value	= 75.57
Azadirichitin Content	= 530 ppm
Saponification Value	= 191.69
Unsaponifiable matter	= 1.91 %

#### *COST OF NEEM OIL*

Rupees 75 per liter  
0.5 lit Neem oil is required for one ton urea.  
Cost increase for one ton urea: Rupees 80-90

#### *NEEM OIL SUPPLIER COMPANIES*

1. SHRIRAM SOLVENT EXTRACTIONS PVT. LTD., INDIA  
KASHIPUR ROAD, U.S. NAGAR, Jaspur - 244712, Uttarakhand, India  
T: 91-5974-222147/222083  
F: 91-5974-220647

2. SUN AGRO IMPEX- SALEM (T.N), INDIA  
Mr. Prabhu. G  
T: 91-000-9042758555  
139-narasothipatty, Opp. to Ramani Hyundai Showroom, Omalur Main Road  
Salem, Salem, Tamil Nadu - 636004, India.

3. SHRI AMBICA OIL CAKE INDUSTRIES, INDIA  
Mr. Nirav Sheth (Partner)  
T: 919909001414

#### *CURRENT PRODUCERS OF NEEM COATED UREA*

National Fertilizers Ltd. (NFL)  
TATA Chemicals & fertilizers Ltd, Babrala  
Indo gulf Fertilizers Jagdishpur (U.P)

#### **Uses of Neem Oil**

##### *For Agriculture Use*

Neem Oil is used to manufacture Neem oil insecticide because it contains azadirachtin, which effects over 600 species of pests including insects, nematodes, fungi and viruses and is completely safe to non-target organisms like beneficial predators, honey bees, pollinators, fish, birds, cattle and human beings.

Azadirachtin of Neem oil is a famous natural anti-feedant, growth regulator and ovipositional repellent for insects, as a major active ingredient, which make it a perfect alternative to chemical pesticides.

Nitrogen from Urea is released in the soil and water and leached by activity of nitrifying bacteria Nitrobacter and Nitrosomonas. These bacteria turn nitrogen in nitrite and then nitrate, which are highly mobile in nature when present in soil. By these processes approximate 50% of nitrogen provided by urea is lost.

Solution to this problem of nitrogen loss of urea is to coat the urea with a substance that can prevent bacterial activity of nitrification.

Why to use Neem as urea coating agent?

Neem has proven nitrification inhibition properties. This way it slow down the process of nitrogen release from urea. It is the best nitrification inhibiting agent till date and better than sulphur.

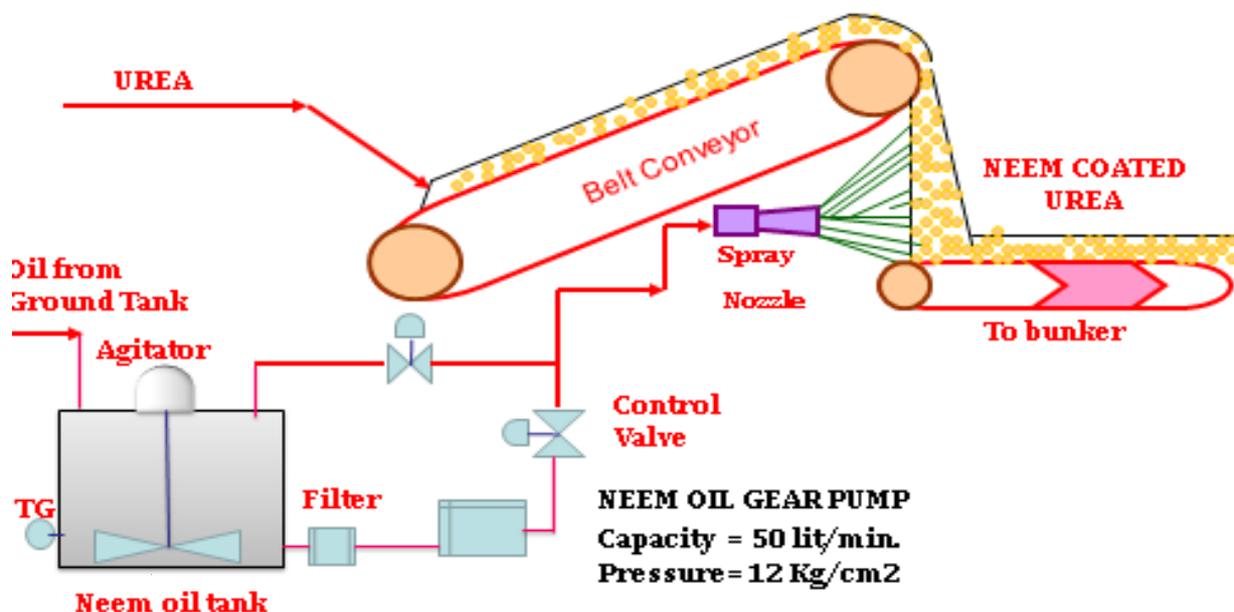
*Benefits of Neem Coated Urea*

- 1) Slow down the process of nitrification of urea
- 2) Enhance the yield by 48%
- 3) Decrease urea requirement, hence save money

The nitrogen (N) fertilizer-use efficiency (20–50%) is low in rice fields in India. The Neem-oil coated urea can increase N-use efficiency in lowland rice, but the desirable thickness of Neem-oil coating onto urea is not known yet. Therefore, field experiments were conducted during kharif (rainy) season years 2004 and 2005 at the Research Farm of Indian Agricultural Research Institute, New Delhi to know the suitable thickness of Neem-oil coating on prilled urea (PU) for increased N-use efficiency and yield.

The treatments comprised of twelve combinations of four N sources (PU coated with Neem-oil thickness of 0, 500, 1000 and 2000 mg/kg PU) and three N levels (50, 100, and 150 kg N / ha) plus a no-N control. Prilled urea (PU) refers to the common urea available commercially prills, which is different from urea super granules. Application of urea coated with Neem-oil thickness of 1000 mg/kg PU resulted in significantly higher growth, yield parameters, grain yield, N uptake, and efficiency of aromatic rice (*Oryza sativa* L.) over uncoated PU. Nitrogen application at 122 kg per hectare was optimum for increased yield of rice. Nitrogen-use efficiency decreased significantly and substantially with each successive increase in levels of N from 50 to 150 kg per ha.

**NEEM OIL SPRAYING ARRANGEMENT**



**FIGURE 1: EQUIPMENT REQUIREMENT FOR NEEM COATED UREA**

Equipment specifications:

1. One unloading pump, one storage tank (10 Te capacity)
2. One Gear pump for transfer self-priming Make: Rotadel Model:RDMS-100M Size = 25 x 25 MOC = AISI 316, Capacity = 20 M<sup>3</sup>/hr at 5 Kg/cm<sup>2</sup> pressure, Working Temp. = 60 degree, Viscosity = 34.8 CST
3. Neem Oil Storage Tank, MOC = M.S Capacity = 15,000 liters

4. Neem Oil Day Tank, MOC = M.S. Capacity = 2500 liters
5. Neem Oil Unloading Pump
6. Make: Kishore Centrifugal Pump Flow = 10 M<sup>3</sup>/hr, Head = 13.6 m, Motor = 2.2 KW, 1450 rpm.
7. Neem Oil Injection Pump, Capacity = 50 ltr/min. Pressure= 12 Kg/cm<sup>2</sup>
8. Nozzle Specification, Capacity=1.78 ltr/min. at 1.75 Kg/cm<sup>2</sup>, Make: Spraying system Company Vee Jet Spray Nozzle Flat Spray, MOC = SS 316, Spray angle = 110 degree

### **NEEM COATED UREA: A STEP IN RIGHT DIRECTION... BUT MORE NEEDS TO BE DONE**

With limited scope for horizontal expansion in the net cultivable area due to demands of an ever-increasing population, it is essential that highly efficient management practices and modern scientific techniques are adopted to increase agricultural production in India. Efficient water and nutrient management are the key elements of intensive agriculture.

At the current use levels of primary nutrients (N, P, K) of 20 million tons, almost two third of this quantity is accounted for, by nitrogen alone. Globally, nitrogenous fertilizers are produced in 72 countries, the total production being 94 million tons in 2002-03 as compared to nearly 50 million tons in 1970. Forecasts suggest that the consumption of nitrogenous fertilizers is likely to rise to 134 million tons in the next decade.

It is worthwhile to note that urea constitutes nearly 80% of the total straight nitrogenous fertilizer consumption in India. In quantity terms nearly more than 20 million tons of urea is used in India currently, and it is safe to presume that urea would continue to maintain its predominant position among nitrogenous fertilizers. On the other hand, globally, due to use of other nitrogenous fertilizers, namely, liquid ammonia, ammonium sulphate and ammonium nitrate, the contribution of urea usage is less than half of the total nitrogenous fertilizers.

#### *Urea transformations*

Under the environmental conditions encountered in most parts of India, urea after application to soils hydrolyses fairly rapidly to ammonium carbonate, over a maximum period of about a week. The ammoniacal form of nitrogen is subsequently converted to nitrite and then to nitrate by the action of nitrifying bacteria viz. Nitrosamines sps. and Nitrobacteria sps., respectively. The processes of hydrolysis and nitrification of urea fertilizer are to a large extent completed in about 15-20 days under most agro climatic conditions. In this context, it should be noted that the duration of most cultivated crops extends beyond 90-100 days, and therefore, nitrates formed as a result of the relatively rapid hydrolysis and nitrification of urea being highly soluble, and in excess of the limited quantities required by the crops at their early stages of growth are liable to be leached down the soil profile, beyond the active root zone of crops. Moreover, under waterlogged conditions nitrates are reduced to elemental nitrogen and nitrous oxide by the action of denitrifying bacteria to meet their oxygen demand.

This leads to the development of nitrogen deficiency and poor crop yields. In view of this it is most important that fertilizer use efficiency needs to be improved to make fertilizer use economically viable and more attractive.

Scientists around the world are concentrating their efforts on regulating the nitrogen supply to crops by reducing the rate of either hydrolysis or nitrification or both, so as to ensure continuous and optimal supply of nitrogen to match the requirements of crops at different stages of growth. A considerable volume of data is available on the potential of the constituents of Neem (*Azadirachta indica*) seeds known as triterpenes as effective nitrification inhibitors. In fact the Indian Council of Agricultural Research in its publication 'Technology for Rice Production' for different states has recommended the use of Neem cake blended or coated urea. In spite of the encouraging results obtained with the use of urea coated with Neem cake, this practice has not attracted the attention of farmers on a large scale because the process of coating urea with Neem cake is cumbersome and because Neem cake is not readily available at the farm level.

#### *Industrial Developments*

During late eighties and early nineties, some industries including M/s. Godrej Agrovet Ltd. developed ready to use Neem extracts containing Neem triterpenes which could be mixed with urea straight away to obtain the Neem coated urea (NCU), thus eliminating the use of Neem cake and coal tar and other additives. Neem coated urea produced using concentrated extracts were extensively evaluated under large field trials and were found to show great yield improvements. At this stage it was envisaged that Neem coated urea could be produced by urea manufacturers, however, urea being controlled under Essential Commodity Act and Fertilizer Control Order, a

special permission by concerned Ministry was required to produce and market fortified urea (Neem coated urea) fertilizer.

Since this exercise was going to take quite some time, as an interim arrangement, manufacturers started marketing Neem based urea coating agents in the market and farmers were advised to mix urea coating agent with urea before application. Currently, more than 20 entrepreneurs sell such Neem based urea coating products in the market

It is heartening to mention here that due to continuous efforts and perseverance of the Industry and Neem Foundation, Government of India finally on May 12, 2003, issued a notification indicating FCO Amendments to include specifications of Neem coated urea to be produced by M/s. National Fertilizers Ltd. (NFL). However, it was clarified that Government of India has decided to permit all the manufacturers who wish to manufacture Neem coated urea at their factories.

It may be pointed out here that only one out of the four demands listed above has been met. NFL, producer of Neem coated urea are absorbing additional costs in their system and do not wish to seek additional selling price for their Neem coated urea.

It would not be out of place to mention here that NFL produces Neem coated urea by using very low quantity of Neem oil emulsion, which is primarily aimed at prevention of caking and reduction in losses during storage. Increase in yield up to 4-5% as claimed by producers (NFL) is considered incidental, whereas on the other hand the product developed by the industry is aimed at improvement in agronomic efficiency as primary objective and reduction in caking and losses during storage being additional advantage. As it has been established for several years, higher agronomic efficiency is attributed to presence of Neem triterpenes for which products need to be specifically formulated. An efficacious and stable Neem coating product would certainly require price support from Government of India.

Therefore, it is emphasized here that by granting permission to manufacture NCU, the authorities in India have taken one step in right direction. However much more needs to be done, if we have to really reap the benefit of this wonderful technological innovation.

In summary, the advantages of the Neem coated urea can be enumerated as follows:

- 1) Saving of 10% of the losses of urea would amount to 2 million tons of urea or a reduction in subsidy component to the tune of 1,700 crores per annum (considering total subsidy on urea to be 18,000 crores per annum)
- 2) Proportional saving in the consumption of naphtha or natural gas
- 3) Increased crop yields due to better nitrogen utilization
- 4) Reduction in environmental pollution of ground water due to leaching of nitrates and gaseous emissions
- 5) Opportunity for entrepreneurs to commercialize local Neem
- 6) Resources and Development of Small Scale Industries in rural areas

#### *Other Benefits*

Apart from the increase in yield, Neem Coated Urea application has other useful effect in paddy and wheat crops. At one of the locations in the state of UP, farmers have observed that the menace of Neel Gai has reduced significantly in paddy crop. In yet another observation, at Panipat, farmers observed no incidence of leaf folder and, stem borer in paddy crop. At Sangrur and Gurdaspur, in the states of Punjab, farmers observed that the incidence of white ant was reduced with the use of Neem coated Urea in wheat crop. This is because of fragrance of Neem oil that on dissolution was released in the standing water in the standing water and insecticidal properties of Neem.

#### *Production of Neem Coated Urea at NFL*

National Fertilizers Limited, in the year 2002, standardized the techniques for production of Neem Coated Urea in situated, at its Panipat Unit. Since then many changes have been made in the process and applicant solution, to have a uniform and consistent coating of Neem oil on urea prills, to maintain the concentration of Neem oil content as per the specification prescribed in FCO. Based

upon the results of extensive field trial where Neem Coated urea was found to be agronomical superior to normal prilled urea.

#### *Why Neem Coat is required?*

Soil fertility is determined by three major elements namely Nitrogen, Phosphorus & Potassium (N, P, K) of which nitrogen plays a very important role. For this reason, Urea (containing 46% of N) consumption is very high all over the world. Unfortunately, more than half (up to 60%) of the nitrogen leaches out or vaporizes in the form of nitrogen gas, ammonia & nitrous oxide due to the presence of denitrifying bacteria in the soil.

Features and benefits of Neem Coated Urea:

- 1) Slow down the process of nitrification of urea.
- 2) Neem Coated Urea reported improved yield up to 48%
- 3) Decrease urea requirement by 50%.
- 4) Controls soil born nematodes, termites and other pest due to pesticide properties
- 5) It is a Next Generation Urea Coating Agent.

#### *Neem Coat Application*

Spread the required quantity of urea in shade and mix Neem Coat (5000 ml per metric ton or 250 ml per bag of 50Kg of Urea) thoroughly; mix the two to get uniformly coated urea. Keep in shade for about three hours before application for deriving maximum benefit from Neem Coat.



**Picture: Good paddy crop due to Neem Coated Urea**