



TECHNICAL DATA BULLETIN

PRODUCT TECHNICAL INFORMATION AND APPLICATIONS

KNOX OUT[®]2FM

(Flowable Microencapsulated Diazinon)

1. GENERAL:

KNOX OUT[®]2FM insecticide is a sustained release insecticide for pest control in and around buildings. Through microencapsulation process, Knox Out combines excellent residual activity with low acute oral and dermal mammalian toxicity.

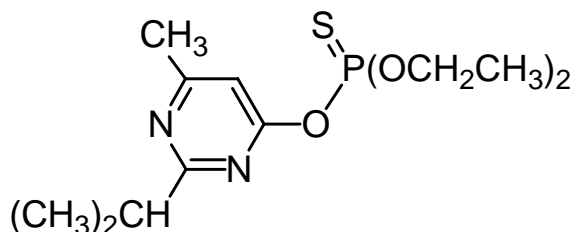
KNOX OUT[®]2FM also exhibits several other desirable characteristics, including consistent performance, negligible insect repellency, excellent activity on different surfaces and low odor as a finished spray.

KNOX OUT[®]2FM is registered for control of cockroaches, ants, fleas, and other pests in and around buildings. Compared to other residual insecticides used in structural pest control industry **KNOX OUT[®]2FM** comes out ahead.

2. PHYSIOCHEMICAL PROPERTIES:

1. ACTIVE INGREDIENT:

Common Name: **Diazinon** (Microencapsulated)
Chemical Group: Organophosphate
Chemical Structure:



Molecular Formula: C₁₂ H₂₁ N₂ O₃ PS
Relative Molecular Mass: 304.3
CAS Registry Number: 333 – 41 – 5
Vapour Pressure: 1.2 X 10 mPa @ 25 C



2. KNOXOUT 2FM

Information in this section presents an overview of Knox Out 2FM insecticide. In addition to the chemical and physical properties that are outlined below there are two other features of Knox Out to be aware of.

1. KnoxOut is a very stable insecticide guaranteed with a shelf life of two years.
2. Laboratory tests show that there is no physical chemical damage to micro-capsules exposed to freezing temperatures. Knox Out has a freeze point of 29°F (-1.7°C). If Knox Out is exposed to sub-zero weather, let product containers thaw out at room temperature and agitate them thoroughly before application

Assay:	Microencapsulated " Diazinon " 240 g/L (23%w/w)
Appearance:	Liquid
Colour:	Beige to Cream
Odour	Mild characteristic odor
Specific Gravity	1.041 @ 20°C
pH	Nominal 8 (1% dispersion)
Freezing Point	0°C
Boiling Point	100°C
Flamability:	Non Flamable
Solubility in water	Disperses
Percent Volatile	70%
Compatibility:	Do not mix this formulation with oil or Kerosen

3. MICROENCAPSULATION:

Microencapsulation process is a technique that encases the active ingredient into droplets with an average particle size of approximately 30 microns. Capsule walls are made of cross linked nylon-type polymer and each capsule contains technical Diazinon. The capsules are suspended in water and the final product is a flowable formulation that contains two pounds of Diazinon per gallon.

Knox Out 2FM Keeps on Working

After application, water surrounding the microcapsules evaporates. Then the technical Diazinon diffuses through the capsule wall, covering the outside surface with small, highly effective amounts of insecticide. As the insecticide dissipates, more chemical diffuses through the wall to replace it. Thus Knox out is still on the job long after most other insecticides stop working.



4. MODE OF ACTION:

KNOX OUT[®]2FM insecticide provides a dual mode of action against tough insect pests. It is both a contact and stomach residual insecticide.

It is generally acknowledged that emulsifiable concentrate insecticides control pests by contact, through exposure of the body surface and entry through the trachea. However, contact insecticides will show stomach toxicity if the opportunity arises. Microencapsulation provides a delivery system that allows a contact insecticide to also act as a stomach poison.

When a cockroach or other insect crosses an area treated with Knox Out, capsules adhere to its body. This increases exposure time and creates a microclimate of toxicant on the insect. Since the pest "carries" microcapsules, it need not remain on the treated surface to obtain a lethal dose of toxicant.

Cockroaches and many other insects continually "preen" or "groom" themselves to remove foreign substances from their bodies. This allows Knox Out's active ingredient to be ingested and act as a stomach poison. This dual mode of action (contact and ingestion), helps explain Knox Out's excellent insecticidal activity. It is also a major reason why Knox Out is so effective against resistant cockroaches.

Negligible repellency:

Even the most effective insecticide can't perform to maximum capacity if target pests avoid it and take refuge in an untreated area of the house or building. Repellency may be the single most important factor that affects the performance of insecticide on cockroaches. Test results show that Knox Out has virtually no repellency. Therefore insects do not avoid treated areas.

5. EFFICACY DATA

Extensive field studies and laboratory research show that Knox Out 2FM insecticide offers consistent performance, even under tough conditions. Pest control operators also report that it has outstanding insect control properties.

The efficacy charts in this section are a representative sample of the product's performance during several years of rigorous testing. They show that Knox Out gives a high degree of control and has an edge over many competitive products.



Performance of Insecticides Against Normal and Diazinon-Resistant German Cockroaches on Treated Panels.

Insecticide	Cockroach Strain ²	%Mortality ¹ Age of Deposits (Days)		
		15	30	60
KNOX OUT (1.0%)	D-10 x R	100-100-100	100-100-100	100-100-100
	N	100-100-100	100-100-100	100-100-100
Propoxur * (1.0%)	D-10 x R	78-92-93	26-51-56	18-23-27
	N	88-96-100	93-100-100	81-98-99
Chlorpyrifos* (0.5%)	D-10 x R	12-33-77	8-40-97	8-52-97
	N	100-100-100	100-100-100	100-100-100
Diazinon (1.0%)	D-10 x R	27-53-92	13-27-55	2-30-57
	N	100-100-100	100-100-100	100-100-100

¹. Under each column, % mortality is for 1, 3 and 6 day exposure period.

². D-10 x R estimated 10 – fold resistance to Diazinon, N-Normal

Summary: In this Laboratory test, Knox Out was the only insecticide to provide complete mortality of both normal and Diazinon-resistant cockroaches.

Performance of Insecticides Against Diazinon-Resistant (14x) German Cockroaches in Treated Apartments

Insecticide	4 Weeks	% Reduction At: 8 Weeks	12 Weeks
KNOX OUT (1.0%) (0.5%)	90.9	90.8	85.2
	64.7		43.1
Diazinon (1.0%) (0.5%)	74.9	56.2	32.4
	0.0	0.0	
Propoxur * (1.1%)	0.0	0.0	15.1
Untreated	0.0	0.0	0.0

Summary: A single application of Knox Out (1% concentration) provided excellent control of German cockroaches in low-income apartments. It was rated as the best material tested because of outstanding performance and low acute mammalian toxicity.



Performance of **KNOX OUT® 2FM** Against Adult Cat Fleas on Aged Deposits on Shag Carpet.

Treatment	% Conc ¹	% Mortality on aged Deposits ²			
		1 Day	1 Week	3 Week	6 Week
KNOX OUT®	1%	100	97	97	100

¹ Applied finished spray at 2 qts. /800 sq. ft.

² Mortality after 24 hours exposure.

6. TOXICOLOGICAL INFORMATION

LOW ACUTE MAMMALIAN TOXICITY

Technical Active Ingredient (Diazinon)

Acute Oral LD₅₀ (rat) 1250 mg/kg

Dermal LD₅₀ for rats >2150 mg/kg

Acute Inhalation LC₅₀ (4h rat) >2330 mg/m³

Not an irritant (rabbits)

No skin irritation or allergy was reported in guinea pigs following repeated exposures to KNOX OUT fi 2FM in controlled skin contact studies.

KnoxOut 2FM

Acute Oral LD₅₀ (rat) >20,000 mg/kg

Dermal LD₅₀ (rabbits) >2,000 mg/kg

Acute Inhalation LC₅₀ (1h rat) 22.4 mg/l

Oral: Practically Non-toxic to Rats.

Dermal: No more than slightly toxic to Rabbits.

Inhalation: Practically Non-toxic to Rats.

Eye Irritation Non-irritating to rabbits

Skin Irritation Non-irritating to Rabbits (4-hr exposure, 0.0/8.0)

KNOX OUT fi 2FM Insecticide

No skin irritation or allergy was reported in guinea pigs following repeated exposures to KNOX OUT fi 2FM in controlled skin contact studies

Microencapsulation greatly reduces the acute mammalian toxicity of the active ingredient in Knox Out 2FM insecticide. This presents obvious advantages for the professional pest control operator and his customers, as well.

Knox Out has acute oral and dermal LD₅₀ values that are greater than 21,000 mg/Kg (rats) and 10,000 mg/Kg (rabbits) respectively. Based on published fig-



ures, Knox Out is 14 times less toxic orally and 5 ¹/₂ times less toxic dermally than pyrethrins, natural insecticides extracted from a variety of chrysanthemums.

The upper graph compares oral and dermal LD₅₀ values of several insecticides. It demonstrates that the toxicity hazard potential for Knox Out is relatively low in comparison to many commonly used insecticides. In addition, Knox Out is not considered a primary dermal irritation or eye irritation. In inhalation tests, Knox Out was non-toxic to rats exposed for one hour to a nominal concentration of 22.42 ppm.

Reduced Inhalation Exposure

Low volatility is another benefit of microencapsulation that makes Knox Out suited to the structural pest control industry. Low odor due to reduced volatility is an important point.

Knox Out yields low, nearly constant levels of active ingredient in the air. The emulsifiable concentrate yields high initial levels of Diazinon that decrease slowly over a period of many days.

7. LOW ODOR

Besides reducing inhalation exposure, low volatility contributes to Knox Out's long residual performance and its lack of an offensive odor as a finished spray. However, a slight odor may arise if microcapsules are disturbed, which can occur if treated carpets are vacuumed after application. This odor dissipates rapidly. This serves to reassure homeowners of Knox Out's continued effectiveness. Knox Out contains no petroleum solvents which characteristically give insecticides an offensive odor.

8. KNOX OUT PERFORMS CONSISTENTLY

Knox Out 2FM insecticide is a long-lasting residual insecticide that performs consistently over a prolonged period. It is not a quick knock down agent.

Effective knockdown in the field generally occurs within four to six hours after application, but may take up to 24 hours under some conditions. The table below compares Knox Out with two commonly used insecticides. The important point is that there is very little variation in Knox Out's knockdown time on different surfaces. In other words, it works consistently.



Mean time required to Produce 50% Knockdown of German cockroaches on porous and non-porous surfaces.

Insecticide	Knockdown Time (Hours)			
	Glass		Filter Paper	
	Fresh Deposit	Four Weeks	Fresh Deposit	Four Weeks
Knox Out 2FM (1.0%)	2.0	1.7	2.5	5.2
Diazinon 4EC (1.0%)	0.7	5.8	6.2	5.8
Chlorpyrifos* 2EC (0.5%)	0.8	2.3	3.7	8.7

Performance on Different Surfaces

The microcapsules that contain Knox Out's active ingredient adhere well to a variety of surfaces and remain available on the surface, factors that help provide consistent, long-lasting performance. In laboratory tests (summarized below), Knox Out and an emulsifiable concentrate formulation of Diazinon were applied to nine common construction materials. In all cases Knox Out gave superior residual performance.

9. APPLICATION INFORMATION:

Knox Out 2FM insecticide is a flowable water-based formulation that is economical to use and convenient to apply. It is available in easy-to-handle one and five gallon plastic containers. Since it is a concentrate formulation, a little bit goes a long way. For example, just one gallon of Knox Out makes over 25 gallons of 1% finished spray.

The following information outlines important use points to help ensure proper application of Knox Out. As with all insecticides, be sure to read the label on the product container and carefully follow all directions and precautions.

Application Equipment and mixing Instruction

Knox Out may be applied with compressed air, hand held or power spray equipment. If application equipment contains spray screens, they should be 50-mesh or coarser to prevent plugging. Do not use 100- mesh screens.

The label on the product container lists the amount of Knox Out to dilute with water to make a 1% finished spray. Once you determine how much to use, the following steps will help ensure proper mixing and application.



1. Thoroughly shake the product container before diluting Knox Out with water.
2. Fill the spray tank half full of water and then add the recommended amount of Knox Out. To facilitate pouring, wet the sides of the measuring cup with water before measuring Knox Out.
3. Add the remaining amount of water to the spray tank.
4. Shake compressed air equipment prior to pressurizing to prevent the forcing of concentrated material into the syphon tube.

How to Apply

Thoroughly treat all areas where insects are known to exist, visit or enter the premises. During application, agitate (invert) the sprayer every ten to fifteen minutes to prevent settling and promote even coverage. A good application job will help ensure proper control, resulting in customer satisfaction and fewer call-backs.

Where to Apply

Knox out has label approval for application in and around buildings, including homes, and apartments, stores, hospitals, nursing homes, schools, manufacturing plants, warehouses, restaurants, hotels, motels, and food processing plants. In food handling establishments application are limited to spot and / or crack and crevice treatments only.

Knox Out will not stain any surface that is not adversely affected by water. A visible residue may occur on smoke dark surfaces. This residue can be minimized by applying Knox Out to these surfaces as lightly as possible with a fan spray. If a visible residue occurs, it can be removed with a cloth or damp sponge. On porous surfaces, such as unfinished wood, simply use a brush to remove any dried residue.

Exterior Perimeter Treatment

Knox Out 2FM insecticide is ideal for exterior perimeter treatment in both commercial and residential areas. Apply Knox Out 2FM for control of ants, carpenter ants, cockroaches, crickets, fleas, silverfish and ticks. Spray to exterior surfaces of building, porches, screens, window frames, eaves, patios, garages and other areas where these pests congregate or enter premises.

While a power sprayer is recommended for treatment, a back pack or compressed air sprayer can also be used effectively. Adjust the nozzle for a fine, light spray at low pressure. The treatment may extend to 6 to 10 feet from the foundation's perimeter on surrounding ground. It is important to remember that Knox Out is a surface treatment, and that run-off should be avoided.

Knox Out can be used in and around livestock housing for control of flies. Spray ceiling and walls of livestock sheds, calf barns, hog barns, loading sheds, corrals and other farm buildings with Knox Out.



Use Knox Out in green houses and interiorscapes for control of Aphids, Fungus, Gnat Larva, Leafminers, Mealybugs, Mites, Scale Insects and Thrips. Refer to label for proper application.

10. AVAILABILITY AND PACKING:

- 0.25, 1.0; 5.0 and 10.0 liters Coextruded HDPE
- 20.0 and 25.0 liters mild steel drums

Sales and Export:

Astra Agricultural Company Ltd.,
P.O.Box 54061, Riyadh, 11514 - Kingdom Of Saudi Arabia
Tel: + 966 1 477 2346 Fax: + 966 1 478 2102