

Commercial Fertilisers and Their Quality Control in Nepal

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Abstract

In Nepal, the fertiliser trade was completely under government control until 1997 and the Agriculture Input Corporation (AIC) had sole responsibility for purchasing and distributing quality chemical fertilisers. The total fertiliser supply was met by imports, and His Majesty's Government of Nepal (HMGN) provided price and transport subsidies to support farmers. As the demand for fertiliser grew, the need for subsidy allocations also grew and the government found it increasingly difficult to afford, resulting in shortages of fertiliser during the main cropping season. To overcome the problem, HMGN deregulated the fertiliser trade in November 1997 and phased out the price subsidies. The deregulation also removed AIC's monopoly in the fertiliser market.

After deregulation of the fertiliser trade, quality control became the major government responsibility. The government promulgated the Fertiliser (Control) Order 1997 under the Essential Commodity Act 1961 and developed the Fertiliser Guideline 1999 using the authority provided by the order. The order and guidelines provided a specific code of conduct for manufacturers, importers, and dealers to ensure the quality of fertilisers. So far, the government has approved the specifications of 27 commercially traded inorganic fertilisers, including 10 micronutrient fertilisers. It has also registered seven organic and biofertilisers. Quality control mechanisms have been developed up to district level by appointing fertiliser inspectors in each district. To ensure the supply of quality fertilisers, a National Fertiliser Policy was developed in 2002 and promulgation of a Fertiliser Act is in process.

In Nepal, the flow of multi/micronutrient fertilisers has been increasing in recent years. Around 15 per cent of farm households were applying fertilisers containing secondary and micronutrients in 2002. Several such fertilisers are available in the market without proper labelling, but with attractive packaging and advertisements. The quality control mechanism for these fertilisers is not efficient. Most of them are applied to soil and crops without testing the crop requirements. These activities may produce adverse effects on both soil fertility and crop yield. Therefore, it is necessary for the government and other agencies concerned to make farmers aware of the correct way to use multi/micronutrient fertilisers.

Background

Agriculture is the largest sector in the Nepalese economy. Fertilisers (organic and inorganic) are inevitably needed to sustain crop productivity in intensive agriculture and to meet the increasing demand for food for the growing population. Farmers in Nepal have been using organic matter such as farmyard manure, compost, and forest litter as fertiliser for their crops since time immemorial.

Chemical fertilisers were first introduced in Nepal in 1952. There was a slow growth in fertiliser use until the 1960s. With the establishment of the Agriculture Input Corporation (AIC) in 1966, a public sector enterprise under the Ministry of Agriculture (MOA), the consumption of fertiliser started rising. The government gave AIC the responsibility for

procuring, storing, and distributing fertilisers in the country. Furthermore, in order to protect farmers from price uncertainties in the world market and to keep the price at an affordable level, the government established a uniform national price for fertilisers by providing price and transport subsidies to the AIC from 1972. As the demand for fertiliser grew over time, the need for subsidy allocations grew with it, and it became increasingly difficult for the government to afford the subsidies. This created shortages of fertiliser during the main cropping season.

In view of the above, His Majesty's Government of Nepal (HMGN) deregulated the fertiliser trade in November 1997 and phased out price subsidies. Recognising the need for quality control in the deregulated market, the government promulgated the Fertiliser (Control) Order 1997 under the Essential Commodity Control (Rights) Act, 1961. To facilitate implementation of the order, a Fertiliser Guideline was developed in 1999. The order and guidelines provided a specific code of conduct for manufacturers, importers, and dealers to ensure the quality of fertilisers. To enforce the order, the government appointed 75 fertiliser inspectors, one stationed at each District Agriculture Development Office (DADO). The government also upgraded the facilities of the central and regional soil testing laboratories such that they could test fertilisers.

Nevertheless, the country continued to experience uncertainties in fertiliser supplies as a result of the high fluctuation of fertiliser prices in the world market, increased cross border flow from India (fertiliser is still subsidised in India), and the lack of confidence of the private sector in the future of the fertiliser deregulation policy (Basnyat 2002). This led the government to issue a National Fertiliser Policy (NFP) in 2002. The NFP included organic, chemical, and microbial fertilisers within the definition of fertiliser.

Crop production is sometimes found to be severely affected due to deficiency of one or more secondary and micronutrient elements. Deficiency of zinc and boron is a commonly observed problem in Nepal. Various formulations of multi/micronutrient and bio-fertilisers are available in the market. Some farmers are using multi-nutrient and bio-fertilisers on a commercial scale. The majority of farmers in Nepal use both organic and inorganic fertilisers. HMGN (2003) found that 81% of farm households were applying both organic and inorganic fertilisers during 2001/02; a further 10% used only animal manure, and 8% only inorganic fertilisers. The application rate for manure was higher in the hills than in the Terai, and the inorganic fertiliser application rate was higher in the Terai than in the hills. Around 15 per cent of farm households used fertilisers containing secondary and micronutrients in 2002.

HMGN (2002) has emphasised, and the Tenth Plan (2002-07) has endorsed, the use of integrated plant nutrient management systems (IPNS) to prevent the degradation of soil fertility and minimise other likely negative impacts of chemical fertiliser use on the environment; and to promote the appropriate and balanced use of fertilisers.

Types of Commercial Fertiliser Used in Nepal

Nepalese farmers apply almost all possible types of fertilisers required for crop production.

Organic/biofertilisers

The organic fertilisers used traditionally in Nepal are compost, farmyard manure (FYM), green manure, and town waste. Usually farmers themselves prepare compost, FYM, and green manure. Based on a study conducted in four districts of Nepal (Chitwan, Tanahu, Kaski, and Parbat), Jaishy et al (1999) reported that in most cases proper composting techniques were not being used. Vermicomposting is gaining popularity in urban areas. *Rhizobium*, *Azotobacter*, blue-green algae, and *Micorrhiza* are important bio-fertilisers that are being tested by researchers and which are used by farmers to a certain extent. Among them, *Rhizobium* is the most important and even the private sector is involved in the production and marketing of inoculants. Some private fertiliser importers are importing and distributing organic and biofertilisers.

Altogether seven organic and biofertilisers have been registered by the Fertiliser Unit of the Ministry of Agriculture and Cooperatives (MOAC) after approval by NFP (see Table 1). Organic fertilisers need to be applied in large quantities to the soil, but they help to build up the soil. Biofertilisers require proper storage temperatures and there are time limits to their use. Thus it seems appropriate to produce both organic and biofertilisers at a local level rather than import them.

Name of product	Country of origin	Organisation registered to import
Meiqi Magic Organic Fertiliser	China	Gangchen International (Pvt.) Ltd
Pensibao Fertiliser (Raja Mall)	China	Pensibao Nepal Trade rs
NAFED Biofertiliser	India	National Cooperative Federation of Nepal Ltd.
Multiplex Annapurna	India (Bangalore)	Bhadra Concern
Kwain-Thong granule bio organic fertiliser New Light bio liquid fertiliser	Thailand	New Lucky Enterprises
Pensibao Multifunctional Nutritive Foliage Fertiliser	China	ANI CHEM NEPAL
Humus Plus 4 (Powder) Carbonite 12 (Granulated)	Australia	Manoj International Traders

Inorganic fertilisers

Among the macro elements required for the growth and development of plants, nitrogen, phosphorous, and potash are required in large amounts and should be added externally. Different types of inorganic fertilisers containing these three elements in straight, complex, and mixed forms are available in the market.

Continuous uptake of nutrients from the soil, haphazard application of inorganic fertilisers, and insufficient use of organic manure create a deficiency of micronutrients in the soil. Deficiency of secondary and micronutrients has been observed in several agronomic and horticultural crops (Joshy and Pandey 1996; Jaishy et.al 1998; Maskey et. al 2004; Tripathi and Harding 2004). The increasing consciousness of farmers and the desire to increase agricultural production has led to a rise in the use of micronutrient fertilisers in recent years. The Fertiliser Unit (MOAC 2002) reported that most of the micronutrient fertilisers available in the market contain more than one element, i.e., they are in multi-nutrient form (see Annex

1). Farmers usually do not know their characteristics and roles, but use them in the name of 'vitamins'.

Only those chemical fertilisers whose specifications have been approved by the government may be traded within the country (HMG/N 1997). Initially, the Fertiliser (Control) Order (FCO) included the specifications of ten commercially traded chemical fertilisers. Realizing the need to have fertilisers containing different nutrients, 17 more fertilisers including secondary and micronutrients were later added to the list (Table 2).

Table 2: List of fertilisers whose specifications have been approved by HMG/N			
	Name	Type	Form/ Description
1	Diammonium Phosphate (18:46:0)	Complex	Granulated
2	Muriate of Potash (0:0:60)	Straight	Crystalline
3	Muriate of Potash (0:0:60)	Straight	Granular
4	Ammonium Sulphate (21:0:0)	Straight	Crystalline
5	Urea (46:0:0)	Straight	Granulated
6	Ammonium Phosphate Sulphate (20:20:0)	Complex	Granulated
7	Ammonium Phosphate Sulphate Nitrate (20:20:0)	Complex	Granulated
8	Nitro Phosphate (20:20:0)	Complex	Granulated
9	Single Superphosphate (0:16:0)	Straight	Powdered
10	Single Superphosphate (0:16:0)	Straight	Granulated
11	Triple Superphosphate (0:46:0)	Straight	Solid
12	Zinc Sulphate Heptahydrate (21% Zn) $ZnSO_4 \cdot 7H_2O$	Straight	Crystalline
13	Zinc Sulphate Monohydrate (33% Zn) $ZnSO_4 \cdot H_2O$	Straight	Powdered
14	Manganese Sulphate (30.5% Mn)	Straight	Solid
15	Borax (Sodium Tetra -borate) (10.5% B) $Na_2B_4O_7 \cdot 10H_2O$ (10.5% B)	Straight	Powdered
16	Solubor $Na_2B_4O_7 \cdot 5H_2O + Na_2B_{10}O_{16} \cdot 10H_2O$ (19% B)	Straight	Solid
17	Copper Sulphate $CuSO_4 \cdot 5H_2O$ (24% Cu)	Straight	Solid
18	Ferrous Sulphate $FeSO_4 \cdot 7H_2O$ (19% Fe)	Straight	Solid
19	Ammonium Molybdate (52% Mo) $(NH_4)_6Mo_7O_{24} \cdot 4H_2O$	Straight	Solid
20	Chelated Zinc as Zn -EDTA (12% Zn)	Straight	Crystalline/powder
21	Chelated Iron as Fe-EDTA (12% Fe)	Straight	Crystalline
22	Calcium Ammonium Nitrate (25:0:0)	Straight	Solid
23	Calcium Ammonium Nitrate (26:0:0)	Straight	Solid
24	Potassium Sulphate (0:0:50)	Straight	Solid
25	NPK(10:26:26)	Complete	Granulated
26	NPK(12:32:16)	Complete	Granulated
27	NPK(20:20:10)	Complete	Granulated

EDTA = ethylenediaminetetracetic acid

Quality Control Mechanisms

It is difficult to bring mixed fertilisers containing micronutrients and hormones (commonly called vitamins) under the quality control mechanism. Quality control of organic fertilisers is also more difficult than that of inorganic fertilisers. Organic fertilisers are prepared from a variety of sources and they are complex. Although the NFP has included organic and microbial fertilisers under the definition of fertiliser, they have yet to be brought under the quality control mechanism.

Regulations

As of 2004, the regulations related to fertiliser quality control are as follow.

- Essential Commodity Control (Rights) Act 1961
- Fertiliser (Control) Order 1997
- Fertiliser Guidelines 1999

The promulgation of a Fertiliser Act is in progress.

Stakeholders involved in the supply of quality fertiliser

The following stakeholders are involved in the supply of fertilisers and their quality control.

- MOAC /DOA/ DADOs
- Fertiliser inspectors
- Local administration
- Authorised laboratories/authorised analysts and other laboratories approved by the Nepal Bureau of Standards
- Importers/manufacturers
- Independent surveyors
- Dealers/retailers
- Farmers

The different responsibilities of and legal requirements for these are summarised in the following.

Role of the Ministry, Department and DADOs

The ministry and the department are responsible for developing regulations and facilitating implementation of the regulations for supply of quality fertilisers to the market. DADOs are responsible for monitoring fertiliser supplies in the districts. They also carry out various training, interaction and other programmes for farmers and fertiliser dealers/retailers in their districts to create awareness about balanced fertilisation and the use of quality fertiliser.

The role of fertiliser inspectors

The ministry has extended the quality control mechanism up to district level by appointing a fertiliser inspector in each district. The fertiliser inspector is an officer level staff member of the DADO. In order to facilitate supply of quality fertilisers to farmers, fertiliser inspectors are assigned the following roles, responsibilities, and authority.

- Monitoring the supply, distribution, and stock of fertilisers in their districts
- Requiring manufacturers, importers, or dealers to submit records on production, import, distribution and stock of fertilisers

- Taking samples of fertilisers or raw materials used in manufacturing fertilisers from dealers/retailers, godowns, or manufacturers at any convenient time
- Investigating whether any person or agency is doing anything against the law or the Act
- Filing cases if any person or agency has manufactured or imported or sold fertilisers against the FCO, or if the sample taken and analysed is of low quality

Local administration

Fertiliser is included in the category of essential commodities. The Chief District Officer (CDO) has the right to look after cases that come under the scope of the Essential Commodity Control (Rights) Act (HMGN 1967). Fertiliser inspectors should take the help of the local administration in performing their duties and filing cases against wrongdoers.

Fertiliser testing and analysing services

There are seven authorised laboratories and one accredited laboratory for testing and analysing all types of fertilisers as per the FCO 1997. These laboratories test reference samples as well as complaint samples. If fertilisers are found to be sub-standard, legal action can be taken on the basis of the analysis reports of these laboratories.

Authorised laboratories

- Soil Testing and Services Section, Hariharbhawan
- Regional Soil Testing Laboratory, Jhumka, Sunsari
- Regional Soil Testing Laboratory, Trishuli, Nuwakot
- Regional Soil Testing Laboratory, Khairanitar, Tanahu
- Regional Soil Testing Laboratory, Khajura, Banke
- Regional Soil Testing Laboratory, Dhangadhi, Kailali
- Nepal Bureau of Standards and Metrology

Laboratories accredited by the Nepal Bureau of Standards and Metrology

- Nepal Environment and Scientific Services

Fertiliser testing kit boxes for testing adulteration of fertilisers

Quick test kit boxes have been developed by the Soil Testing and Services Section of the DOA and distributed by the MOAC in the 24 Terai and valley districts, as these are prone to sales of substandard fertilisers. With the help of these kit boxes, adulteration in different types of fertilisers can be tested instantly. The ministry has also provided training to the DADO staff and fertiliser dealers in all the 24 districts on the use of the kit boxes. This is designed to enhance district capabilities for protecting farmers from the purchase of fake fertilisers.

Fertiliser importers

- Only those fertilisers can be imported which have approved specifications as per the FCO 1997, Section 5.
- The following certificates are mandatory for importers when importing fertilisers from abroad:
 - Manufacturer's certificate to ensure the country of origin and nutrient contents in the fertiliser including the chemical composition;
 - Loading port certificate from an independent surveyor (international) to guarantee the quality, quantity, packaging, and labelling

- Unloading point certificate to guarantee the quality, quantity, packaging, and labelling

The manufacturer's certificate and the loading port certificate from the country of export should be presented at the point of entry in Nepal (customs' office). The unloading point can be the customs entry point or importer's godown (HMGN 1997). There are accredited independent surveyors available to issue the unloading point certificate.

Loading port certificates should match the unloading point certificate (within the tolerance limit). Packaging and labelling of imported fertiliser should be as per the FCO 1997, Section 20. Every importer should submit a monthly report to the Fertiliser Unit of MOAC on import, distribution, and stock of fertilisers (HMGN 1999).

Manufacturers

- Fertiliser manufacturing companies should register their fertilisers at the Fertiliser Unit, MOAC, before manufacturing. For this, fertiliser companies should submit applications to the Fertiliser Unit as per the FCO, Section 13.
- Periodic reports should be submitted to the Fertiliser Unit on production, sale, stock, and price of fertilisers.
- The registration certificate of registered fertilisers should be renewed with the Fertiliser Unit every three years.

At present, three mixing and blending companies have registered different grades of fertilisers and are manufacturing fertiliser grades of 20:20:0 and 20:20:10.

Independent surveyors

Importers and manufacturers should obtain certificates from independent surveyors that verify the quality, quantity, labelling, and packaging of fertilisers. The requirements should be met for quality, quantity, labelling, and packaging as per the FCO. For this purpose, the MOAC has accredited the following surveyors

- Investigators, Legal Advisors and Surveyors, New Road Gate
- Nepal Environmental and Scientific Service (P) Ltd., Thapathali
- Sata Engineering Associates, Dugambahil, Kathmandu
- International Claim Bureau, Thapathali, Kathmandu

Dealers/retailers

- Any firm or person wishing to sell fertiliser needs to secure a certificate of registration from the appropriate DADO as per the provisions of the FCO. The registration certificate is valid for two years from the date of registration or renewal.
- As per the provisions of the Fertiliser Guidelines 1999, Section 5, every dealer should submit a monthly report to the DADO or the Service Centre/Sub-Service Centre on fertiliser transactions.

Conclusions

The commercial fertilisers used in Nepal are mainly inorganic fertilisers containing nitrogen, phosphorous, and potash. Farmers, fertiliser dealers, extension workers, laboratory technicians, and other stakeholders are familiar with the nitrogenous, phosphatic, and

potassic fertilisers, and complex fertilisers containing these three nutrient elements. The rules and regulations for controlling the quality of these fertilisers are well specified and the laboratory facilities for testing and analysing them are also well developed. Considering the importance of IPNS for sustainable soil-fertility management in intensive agriculture, the NFP has broadened the definition of fertilisers to include organic, inorganic, and microbial fertilisers. However organic and bio-fertilisers have yet to be brought under the legal framework.

The use of inorganic fertilisers containing micronutrients has been practised in a haphazard way by some farmers, without knowing their characteristics and roles. Since micronutrients are required in small quantities for plant growth, soil nutrient testing facilities also need to be extended so that they can assess soil nutrient levels and requirements. Users, extension personnel, traders, and other stakeholders are not so familiar with these fertilisers. Therefore, the quality control mechanism for these fertilisers needs to be developed in order to protect farmers from their misuse and to promote sustainable agricultural development.

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Annex 1: Characteristics of the 23 micronutrients available in Birgunj as per the study conducted by the Fertiliser Unit in 2002							
Name of product	Content	Available quantity (pack)	Price* (US \$)	Recommended dose	Target crop	Manufacturer	Remarks
Multiplex (liquid) for Foliar Spray	Fe	0.5%	0.52	50 ml in 20 litres of water	Field, horticultural and plantation crops	Karnataka Agro Chemicals Bangalore	
	Mn	0.2%	0.98				
	Zn	5%					
	Cu	0.5%					
	Mo	0.02%					
	B	0.5%					
Multiplex Zinc EDTA (Solid)	Zn EDTA	12%	0.70	250 gm Zn EDTA in 500 litres of water sufficient for one ha of land	Field, horticultural and plantation crops	Karnataka Agro Chemicals Bangalore	
	B	10.5%	1.40	500 gm in 200 litres water	Field, horticultural and plantation crops	Karnataka Agro Chemicals Bangalore	
Multiplex, Zinc High (Soil Application)	Fe	1%	0.56 (Nepal)	15 kg/ha	Field, horticultural and plantation crops	Karnataka Agro Chemicals Bangalore	
	Mn	0.2%	0.88 (India)				
	Zn	8%					
	Cu	1%					
	Mo	0.03%					
	B	1%					
Agromin Foliar Multi Micronutrient Fertiliser	Fe	0.5%	0.85	0.5-1% for wheat, maize, pulse, oilseed, vegetables; 1-2% for sugarcane	Cereals, vegetables and cash crops	Aries Agrovet Industries Ltd, Aries House Plot No. 24 Deonar, Gorandi Mumbai 400043	
	Mn	0.2%	3.37				
	Zn	3%	-				
	Cu	0.5%					
	Mo	0.02%					
	B	0.5%					

EDTA = Ethylenediaminetetraacetic acid, N = nitrogen, Ca = calcium, Mg = magnesium, S = sulphur, Zn = zinc, Mn = manganese, Fe = iron, Cu = copper, B = boron, Mo = molybdenum, Cl = chlorine. *Original prices in NRs and IRs converted at a rate of US\$1= NRs 71, or IRs 44

Annex 1: cont.

Name of p product	Content	Available quantity (p ack)	Price* (US \$)	Recommended dose	Target crop	Manufacturer	Remarks
Agromin Soil Application (Chelated)	Fe	1 kg	0.74	20-30 kg/ha			
	Mn	2.5 kg	-				
	Zn	5 kg	3.16				
	Cu	(1 kg technical)	-				
	Mo	(4 kg carrier)	-				
B	10 kg	5.90					
Chelamin (Zn) Foliar Spray	Zn EDTA	50 gm	0.93	250 gm in 250 litres of water for one hectare area with standing crop	Cereals, vegetables and cash crops	Cereals, vegetables and cash crops	
	N	100 gm					
Chelamin soil application chelated	Zn	500 gm	8.42	500 gm technical and 10 kg carrier for 1 ha of land			
		500 gm technical + 10 kg carrier					
Microplex (Foliar Spray) (Liquid)	Zn	1 litre	2.92	500 ml in 100 litres of water	All crops	Microplex (India) A -1, A-2, MIDC Wardha (M.S.)	
	Fe	5%					
	Mn	0.2%					
	Cu	0.5%					
	Mo	0.02%					
	B	0.5%					
Microplex (Foliar Spray) Liquid	Fe	100 ml	0.52	500 ml in 100 litres of water	All crops	Microplex (India) A -1, A-2, MIDC Wardha (M.S.)	
	Mn	0.5%					
	Zn	8%					
	Cu	0.2%					
	Mo	0.01%					
	Chelated						
Zinoplex - F (Foliar Spray)	Zn	200 gm	0.70	500 ml in 100 litres of water	All crops	Microplex (India) A -1, A-2, MIDC Wardha (M.S.)	
		12%					
Hi Power Liquid Micronutrient fertiliser	Zn	100ml	0.70	350-500 ml in 150-200 litres of water	All crops	Ever Green Chemical India, Usha Kiran Building, Azaolpur Commencial Complex, Delhi - 33	
	Fe	250 ml	1.47				
	Mn						
	Cu						
	Mo						
	B						

Annex 1: cont.

Name of product	Content	Available quantity (pack)	Price* (US \$)	Recommended dose	Target crop	Manufacturer	Remarks
Evergreen vegetable special	Zn 5% Fe 2% Mn 2% Cu 0.5% Mo 0.05% B 0.5% (PH 3.5)	0.5 kg	1.19	3 g/litre of water	Leafy vegetable beans cucurbits, onions, garlics	Ever Green Chemical India, Usha Kiran Building, Azaolpur Commercial Complex, Delhi - 33	
High Zinc (soil application)	Zn 6% Fe 3% Zn 1% Cu 0.05%	10 kg bag		3 g/litre of water	Cereals crops	Ever Green Chemical India, Usha Kiran Building, Azaolpur Commercial Complex, Delhi - 33	
Micro power foliar spray	Increase efficiency of nutrients	100 ml	0.72	1250 ml in 500 litres of water for 1 ha	Cereals crops	Jitesh Chemicals Co., Mumbai	
Micro power foliar spray	Fe 0.5% Zn 5% Mn 0.2% Cu 0.5% B 0.5% Mo 0.02%	100 ml	0.42	100 ml in 150 -200 litres of water	Cereals crops	Jitesh Chemicals Co., Mumbai	
Durga shakti zinc High soil application	Fe 1% Mn 0.2% Cu 1% Zn 8% Mo 0.03% B 1%	1 kg 5kg	0.90 4.27	15 kg/ha	Cereals crops	Durga Chemical and Fertilisers Lakhisarai, India - 811311	
Tracel - 2 micronutrient spray chelated	Zn 5% B 0.5% Cu 0.5% Mo 0.02% Mn 0.2% Fe 0.5%	500 gm		5 gm/litre, 750 litres of spray for 1 ha land	Cereals, oil seed, pulses, vegetable and fruits	Rallis India Agro Chemical India	Contains balanced micronutrient , potash 7% and Mg 1.2%
Multi nutrition chelated zinc	Zn EDTA12% N 3.5%	250 gm	1.57	500 g of multi nutrition per hectare	Wheat, potato, sugarcane, cotton and other crops	J.B. Chemicals Dhrashan Ganj Lucknow	
Agron Plus High Zinc Soil application	Not mentioned	1 kg	0.56	2.5 kg/ha	Paddy, wheat, sugarcane	S.D. Biotech Ltd. Industrial Area, Alipur, Delhi	

