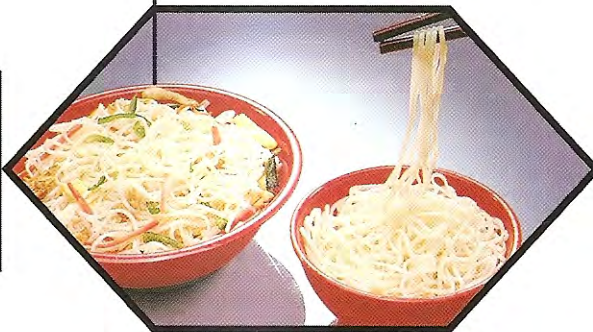
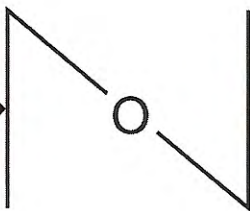




Lucid Colloids Ltd.

EDICOL[®]



“Gums play an important role in our perception and appreciation of food products. The enjoyment of our food represents an improvement in the quality of our lives. Through physical stabilization, gums enable the most efficient packaging, transportation and storage of processed foods, leading to less wastage of limited natural resources.”



Guar Gum is derived from the seeds of the Guar plant - "Cyamopsis Tetragonolobus". It is an annual plant, about 4 feet high, vertically stalked, with large leaves and clusters of bean-like pods. Each pod is about 5-8 cms long and has on an average 6-9 small, greyish white pea shaped seeds. Guar is a hardy, drought resistant bush which grows well in the semi-arid areas of west and north-west India and parts of Pakistan. Guar grows best in sandy soils. It needs moderate, intermittent rainfall with lots of sunshine. Too much

precipitation can cause the plant to become more "leafy" thereby reducing the number of pods and/or the number of seeds per pod which affects the size and yield of seeds. The crop is sown after the first rains in July and harvested in late October. The pods are then sun dried, manually separated from the seeds and the seeds are supplied to the industry for processing. Tender green Guar pods are also consumed as a vegetable and cattle-feed in India.

The Guar seed is dicotyledonous having a diameter of about 2.0-3.0 mm. The seeds make-up about 60%-70% of the pod weight. The germ is completely enveloped

by the 2 halves of the endosperm and it is the endosperm that is the source of the gum. The tough seed skin or husk is of a fibrous nature,



composed of compressed thin layers of cellulosic material.

The gum is commercially extracted from the seeds essentially by a mechanical process of roasting, differential attrition, sieving and polishing.

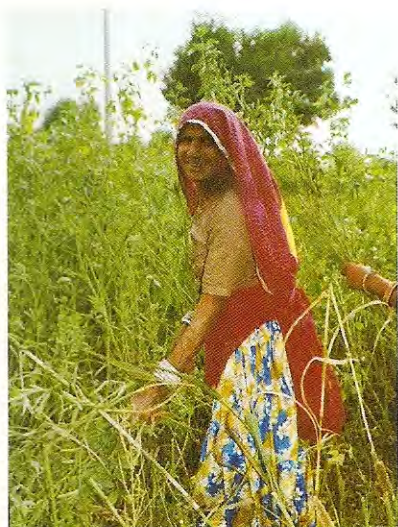
The seeds are broken and the germ is separated from the endosperm. 2 halves of the endosperm are obtained from each seed and are known as Undehusked Guar Splits. When the fine layer of fibrous material which forms the husk is removed and separated from the endosperm halves by polishing, Refined Guar Splits are obtained. The husk and germ are rich in protein and form a valuable

cattle-feed. The larger germ particles have a high content of oil and albuminoids (o & a) - about 55%. The smaller germ particles

have an o & a content of about 40% and the husk about 25% o & a. Various standardised blends of these "Guar meals" can be made to achieve standard o & a contents. Guar meal may also be toasted to reduce odour and remove trypsin inhibitors. This is known as Toasted Guar meal and is sold in the international markets. This product is usually standardised at 45% o & a content.

The refined Guar splits are then treated and finished into powders by a variety of routes and processing techniques depending upon the end product desired. High purity Guar gums like **Edicol®** for foods, feeds and





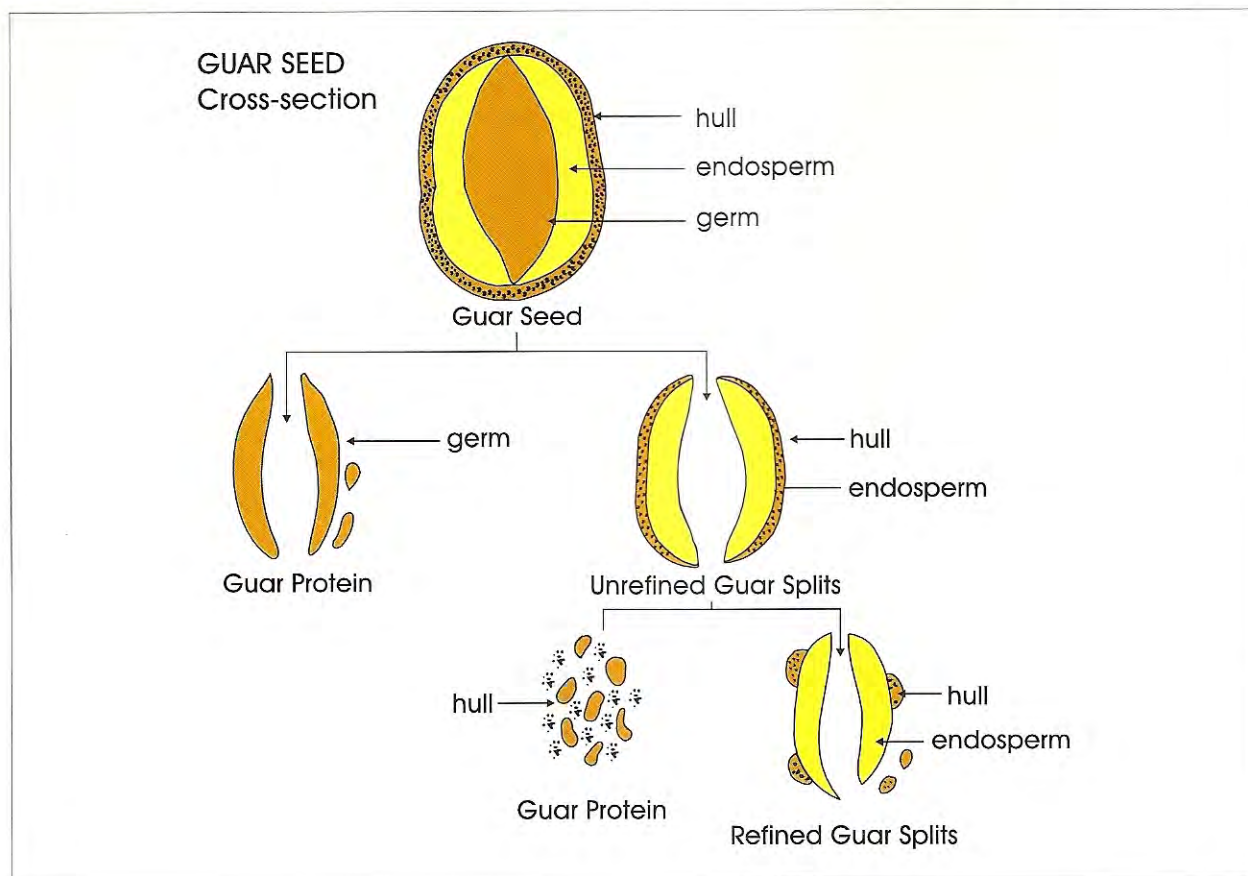
modified / derivatised Guar gums such as hydrolysed, hydroxyalkyl, carboxyalkyl, oxidised, sulphated, borated, cationic and various combinations of these are commercially useful for a number of industrial applications.

Properties

Edicol® is one of the most cost effective and efficient water soluble polymers known. It forms highly viscous solutions at low concentrations. It exhibits Non-Newtonian rheological properties and yields acid reversible gels with Borax. Due to the unique properties of this gum, it finds wide application in foods, pet-foods and feeds.

Edicol® is a plant seed hydrocolloid - a cold and hot water soluble galactomannan polysaccharide derived from the seeds of the Guar plant 'Cyamopsis Tetragonolobus'. Chemically, it is composed of a beta 1-4 linked linear mannose backbone chain with single galactose side unit on approximately every other mannose unit, in a 1-6 alpha linkage. The molecular structure reveals that it is a rigid rod-like polymer due to the beta linkage between the monomer units. The mannose to galactose ratio has been estimated at 1:8:1 to 2:1. Recent studies indicate that the galactose side units may not follow a regular

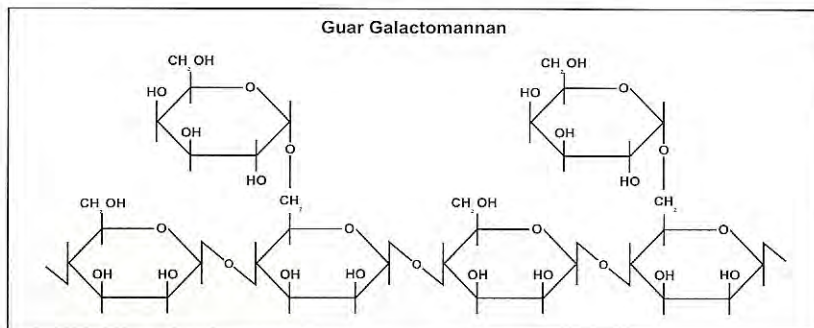
pharmaceutical applications can be produced in many different viscosities, hydration rates and particle size distributions to suit specific applications. Various



spacing pattern, but in fact, may appear in “clusters” and on either side of the mannose backbone and the molecular weight of Guar

have a slight characteristic “grassy or beany” odour.

Edicol® forms highly viscous colloidal dispersions when



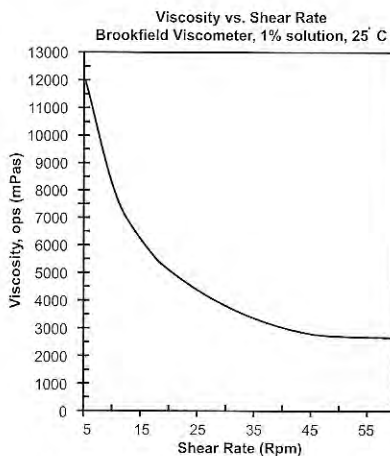
Gum has been estimated as high as 1.8 - 2.5 million. Depolymerised **Edicol®** products have significantly lower molecular weights. Usually, viscosities can be directly related to the molecular weight.

In general, it is the high galactose (to mannose) molar ratio that accounts for the excellent cold water solubility of **Edicol®**. An important feature of **Edicol®** structure to be noted is the cis-position of the adjacent hydroxyl groups on the C2 and C3 in the mannose and C3 and C4 in the case of galactose. This is an important factor since these adjacent hydroxyl groups reinforce each other in hydrogen bonding reactions.

Edicol® is a non-ionic, white to cream white powder, soluble in hot and cold water, but insoluble in most organic solvents. It is commercially used in foods, pet-foods and feeds for its excellent ability to control rheology by economic water phase management. It is neutral in taste, but may

hydrated in cold water. These solution exhibit Non-Newtonian, pseudoplastic rheological properties. Aqueous solution viscosities decrease with increasing rates of shear.

Edicol® aqueous dispersions, like most hydrocolloids, obey the power law :



$$\tau = k\gamma^n$$

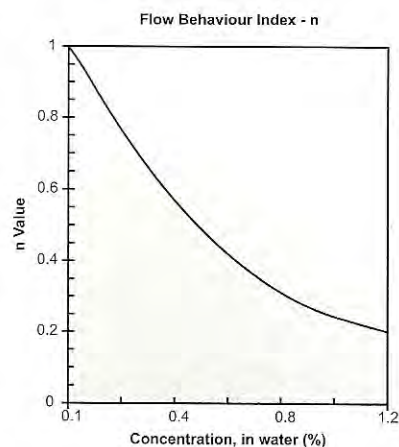
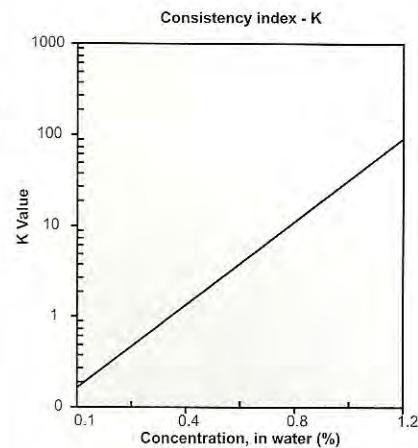
Where τ = stress,

γ = shear rate,

k = consistency modulus,

n = flow behaviour index.

The lower the value of n , the greater the shear thinning effect (loss of viscosity on increasing

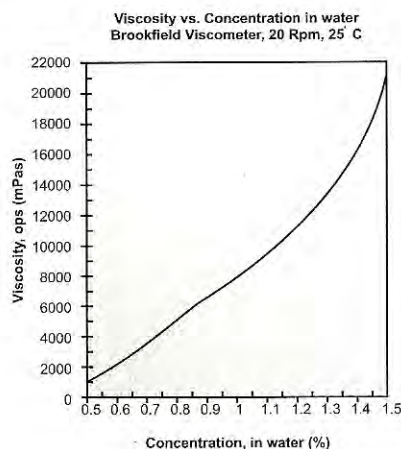


shear). For an ideal Newtonian fluid, the viscosity is independent of shear and therefore $n = 1$. Numerous studies have shown that solutions with a high “ n ” value tend to feel slimy in the mouth. Therefore, when high viscosities and a good, clean mouth-feel are desirable, hydrocolloids like **Edicol®** with low “ n ” values are the gums of choice.

Edicol® solution viscosities increase exponentially with increasing concentration of **Edicol®** in water. In addition to shear rates and polymer concentration, **Edicol®** solution visco-

sities are also influenced by previous shear history, temperature, pH and the presence of salts and other solids. The time required for **Edicol**® to completely hydrate in water and reach peak viscosities depends upon the grade of **Edicol**®, the dispersion and stirring equipment used, the pH and temperature. **Edicol**® viscosities will tend to irreversibly reduce if the dispersion is sheared at very high speeds for extended periods. Such a reduction is more pronounced at elevated temperatures and extremes of pH.

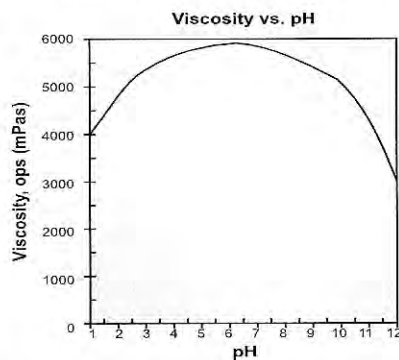
Edicol® is stable over a wide pH range. Due to the non-ionic nature of the product, almost



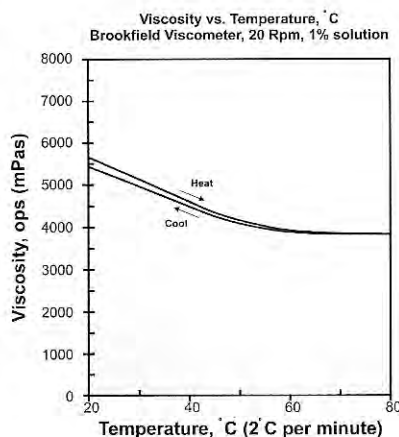
constant viscosity is maintained in the pH range of 3-10. The optimum pH range for hydration of **Edicol**® is 5.5-6.5.

The viscosities of aqueous **Edicol**® dispersions are not significantly affected by temperature. Hydration rates (rate of viscosity development) are influenced by short term heating.

Edicol® will reach peak viscosities faster if the dispersion is



heated to about 40°C for a short while. Beyond 40°C and upto 80°C, viscosities will decrease, but will recover on cooling, though this depends upon the holding time



at the high temperature and the pH. For example, **Edicol**® solutions having a pH of 4-9 exhibit good thermal stability when heated to 80°C and held for two hours and cooled again, but will thin irreversibly if the pH is held during this period at 3. Under normal conditions, **Edicol**® exhibits excellent freeze-thaw stability with insignificant syneresis in food products. Rheological properties of

end products with **Edicol**® remain stable when refrigerated, stored at room temperatures or heated.

Since **Edicol**® is non-ionic, good electrolyte compatibility is achieved over a broad ionic strength range. Very high concentrations of multivalent salts will affect hydration and may produce gels. Addition of other solids to **Edicol**® dispersions will affect the rheological behaviour of the dispersion due to the competition for water between **Edicol**® and the other solids. The change in **Edicol**® dispersion behaviour is affected not only by the concentration of other dissolved solids, but also whether such solids are added to the dispersion before, after or with **Edicol**® to the aqueous phase.

Edicol® solutions will tolerate only small amounts of organic solvents. The polymer will precipitate out of solution and viscosities will reduce sharply when the weight % organic solvent in solution exceeds levels of 5%-10%.

Edicol® is compatible with other gums, starches, hydrocolloids and gelling agents both natural and synthetic, normally used in foods, pet foods and feeds. Excellent viscosity synergism is achieved, without gel formation, with Xanthan gum in ratios of 50:50 to 90:10 (**Edicol**® : Xanthan). Unique stabiliser blends, both cost effective and functional can be

achieved by combination of **Edicol®** with other hydrocolloids, gelling agents and emulsifiers to achieve the right mouth-feel and texture in the final food product.

Like most natural galactomannans, **Edicol®** solutions are subject to degradation by microbial attack and hydrolysis. GRAS preservatives may be added to **Edicol®** to extend solution shelf-life. Due to its high microbial purity, **Edicol®** has a long shelf-life in its dry form.

Edicol® Guar Gums are available in a variety of viscosities, particle size distributions and hydration rates to suit every need. Detailed specification sheets are available on request. Specialised “tailor-made” products are possible.

Edicol® are high purity Guar gums manufactured under strict hygienic condition and GMP's. The manufacturing process from raw material to finished goods is fully automatic, incorporating complex pneumatic conveying and material handling system. Various safety features and HACCP during manufacturing and packaging ensure that **Edicol®** is free from foreign matter and impurities.

Average standardised / blended batch sizes range from 5,000 to 8,000 kilos (11,000 to 17,500 lbs), thus ensuring consistency and reproducibility from batch-to-batch. Every batch shipped to customers carries a certificate of analysis,

including microbiological certification by our in-house microbio-



logical quality control laboratories. Our well-equipped labs are capable of carrying out various tests and analytical procedures. No preservatives are added to **Edicol®**, including GRAS preservatives.

Edicol® must be stored in a cool, dry place, away from heat and out of the sun. It is recommended to use all the contents from a **Edicol®** bag/container, within a reasonable time, once



opened. Due to the hygroscopic nature of the product, excessive humidity may lead to absorption of moisture and consequent microbial degradation if bags/containers are left in an open state for long periods.

Edicol® is available in 25 kgs

or 50 lbs net, multi-wall paper (open mouth or valve filled) bags



with a suitable liner or coated paper as a moisture barrier. Other packing is available on request (Plastic bags, Fibre drums, Jumbo sacks etc.). Pallets are also available on request.

For Safety, Health, Environment and Handling, see Material Safety Data Sheet.

In order to obtain lump-free, homogeneous solutions and aid dispersion, **Edicol®** should be dry blended with other ingredients used, such as sugar, starches etc. Such a pre-blend should be added to the vortex created by an agitator.

Edicol® may also be slurried in certain miscible non-aqueous liquids (alcohol's, glycol's etc.) and poured into agitated water.

Eductor systems may be used to make stock solutions, but care must be taken to pre-blend relatively free-flowing materials with **Edicol®** to aid in having a controlled and even rate of discharge from hoppers etc. On its own, **Edicol®** may have a tendency to bridge or form “rat-holes” in hoppers and bins.

A high-speed mixing device is recommended to make **Edicol®** solutions. This ensures no formation of lumps, faster hydration and more homogeneous solutions. A holding period of upto 4-6 hours ensures that **Edicol®** solutions have completely hydrated and reached their peak viscosities. Heat upto 40°C may be employed through a jacketed vessel to speed up the rate of **Edicol®** hydration in water.

high viscosities; its pseudoplastic rheology and its relative stability over a wide pH and temperature range make it a highly efficient and



food requiring the scientific management of its water phase is a potential application for **Edicol®**. **Edicol®** is used as a stabiliser, thickener, viscosifier, rheology control agent, bodying and suspension agent, texture and consistency modifier.

Edicol® brings about stabilisation, often in combination with other hydrocolloids, by modifying and controlling the behaviour of water in a food or feed. **Edicol®** may act as the primary or supporting stabiliser ingredient. In various frozen dairy and non-dairy products like ice-creams, ice-milk,

Applications

Edicol® properties to rapidly hydrate in cold water and yield

cost effective ingredient in many food stability systems. Any

Edicol® Grades

Grade	Hydration	Dispersibility	Viscosity	Particle size
Edicol® 70-70	Fast	Poor	Very high	Fine
Edicol® 60-70	Fast	Poor	High	Fine
Edicol® 60-60	Medium fast	OK	High	Medium coarse
Edicol® 60-50	Medium	OK	High	Coarse
Edicol® 60-30	Medium slow	Good	Medium high	Coarse
Edicol® 60-10	Slow	Very good	Medium high	Very coarse
Edicol® 60-00	Very slow	Excellent	Medium high	Very coarse
Edicol® 40-70	Fast	Poor	Medium high	Fine
Edicol® 40-60	Medium fast	OK	Medium high	Medium coarse
Edicol® 30-70	Fast	Poor	Medium	Fine
Edicol® 30-60	Medium fast	OK	Medium	Medium coarse
Edicol® 30-50	Medium	OK	Medium	Coarse
Edicol® 30-40	Medium slow	Good	Medium low	Coarse
Edicol® 30-10	Slow	Very good	Medium low	Very coarse
Edicol® 20-70	Fast	Poor	Low	Fine
Edicol® 20-60	Medium fast	OK	Low	Medium coarse
Edicol® 20-20	Slow	Good	Very low	Very coarse
Edicol® ULV-50	Fast	Good	Ultra low	Fine
Edicol® ULV-100	Fast	Good	Ultra low	Fine
Edicol® ULV-200	Fast	Good	Ultra low	Fine
Edicol® ULV-500	Fast	Good	Ultra low	Fine
Edicol® ULV-1000	Fast	Good	Ultra low	Fine

ice candies, sherbets, milk shakes etc., **Edicol®**, either alone or in combination with other



hydrocolloids like Carrageenan and Locust bean gum is used to prevent the formation of ice crystals during freeze-thaw cycles, to impart a smooth and creamier texture to the product, to increase overrun and improve chewiness. **Edicol®** prevents quick meltdown and increases shelf life.

In cottage cheese dressings, **Edicol®** promotes curd integrity by lubricity and binds the free water to yield a homogeneous stable product. In soft cheese products, processed cheese spreads and dips, the use of **Edicol®** helps eliminate syneresis and improve texture and flavour due to better control of moisture and fat/oil migration. **Edicol®** also increases yield, aids drainage and imparts a soft, compact and tender texture to recovered curd.

In various baked goods, the use of **Edicol®** promotes a dough having excellent film properties, particularly in low gluten flours. Baked goods like rolls and breads

with **Edicol®** have an improved shelf life due to better moisture retention, softer textures and higher loaf volume on baking. Cake and biscuit dough's benefit by incorporating **Edicol®** leading



to better softness, better mould release and less crumbling during slicing. In dry cake mixes, **Edicol®** offers several advantages, it aids one step mixing, gives shorter batter mix time, yields improved internal structure, prolongs shelf life, improves application of icings and frostings and permits freezing of the cake.

The use of **Edicol®** in juices, nectars and syrups helps in the homogenous dispersion of pulp during filling and storage. **Edicol®** also leads to improved mouthfeel



in these products. In fruit based beverages, **Edicol®** helps in solids suspension and can be

effectively combined with emulsifiers to prevent separation of flavour oils in the container.

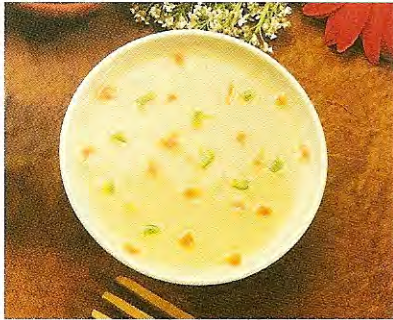
In canned foods and canned pet-foods, **Edicol®** is widely used as a viscosifier, processing aid and protective colloids. **Edicol®** offers the advantages of less



wastages due to splattering during the working process, easier pumping of finished product to filling equipment, less splashing and therefore more accurate control during can filling and a homogeneous dispersion of solids in the liquid phase throughout the filling process. The finished goods augmented with **Edicol®** exhibit good storage stability as there is no migration of fat, and the water and solids are maintained in a good emulsion state. In canned pet-foods, removal of the product from the can is also easier due to the friction reducing properties that **Edicol®** imparts. A partial replacement of starch and flour with **Edicol®** in canned foods helps to reduce sterilisation and cooling time since it acts as a protective colloid to reduce starch

retrogradation.

Edicol® is used as an effective viscosifier in soups, sauces and gravies, either alone or in combi-



nation with Xanthan gum and is complimentary to the use of starches. **Edicol®** helps provide a uniform viscosity to the product over a wide temperature range and imparts good cling to sauces and gravies.

In pourable salad dressings, **Edicol®** is often used with Xanthan Gum and Propylene Glycol Alginate. **Edicol®** helps to enhance the mouthfeel, gives controlled pourability, suspension of solids and improved cling. Due to its excellent cold and hot water solubility, **Edicol®** can be very effectively used in instant products like soup and sauce mixes, instant drinks and desserts.

Edicol® is also used in various

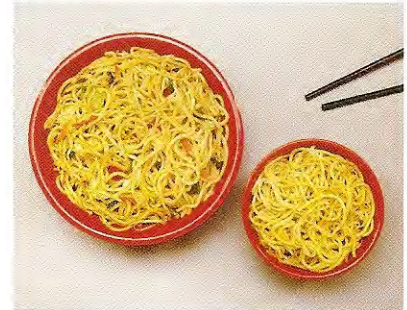


restructured or fabricated foods for better water retention and paste workability and integrity before the final structuring of the fabricated food. **Edicol®** is used as an additive in food extrusion applications due to its excellent water holding and friction reducing capabilities.

Edicol® is used in the preparation of noodles and pasta products; in pickles and relishes



and in canned seafood. Fish feed formulations incorporate **Edicol®** in the dry-mix which aids



in the making of an excellent homogeneous fish feed paste when reconstituted with water and fresh minced fish. **Edicol®** is used as a binder in feed pellets.

Edicol®, besides its major function of water retention, viscosifying and thickening is also finding increased use in foods as a source of natural water-soluble fibre; to improve mouthfeel and texture in low fat/no fat foods (specially in combination with certain starches and other hydrocolloids like microcrystalline cellulose); in slimming aids and dietetic foods; in products requiring "all natural" labelling; as a binder, film former and protective colloids and as a stabiliser in sour dairy products.

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