

## Cellulose Nano Fiber (CNF)

Cellulose nanofiber (CNF) has the size of 4-20 nm in width and several micrometer in length with large aspect ratio. Weight of cellulose nanofiber is approximately 1/5 of iron steel although possess 7-8 times strength of iron steel. Thermal expansion coefficient is as small as glass fiber whereas elasticity modulus is higher than that of glass fiber (meaning hard, strong and robust material). Cellulose nanofiber is made of plant, tree and woods based biomass therefore very recyclable and biodegradable. They can be synthesized from most kind of woods based biomass resource so that raw material is very abundant, and can be cheap.

Therefore, cellulose nanofiber is the excellent green nano materials for the next generation future and research and development have been going on very actively in the world.

### 1. Strong and light weight

Weight of cellulose nanofiber is approximately 1/5 of iron steel although possess more than 5 times strength of iron steel which is even close to the physical property of carbon nanofiber.

Therefore, cellulose nanofiber is mixed with resin, thermoplastic etc... and can be applied to parts of automotive, airplane and architecture which would results in much of weight and energy saving.

### 2. Transparent

Cellulose nanofiber is basically chemically and physically untangled plant fiber. So that one of the fibers has the diameter only in 4 – 20 nm Cellulose nanofiber can be mixed into transparent resin such as acryl, epoxy resin to be reinforced while maintaining its transparency since the size of cellulose nanofiber is much smaller than visible light

wavelength range (400-800 nm)

### **3. Low Thermal Expansion Coefficient**

Cellulose nanofiber will not expand even under high temperature so that can be used to increase the viscosity of such products as cosmetics, also can be replacement of glass.

### **4. Huge quantity of material resource**

Cellulose nanofiber is made from woods, trees, plant based biomass materials so that material resource is huge, and can be economically cheap in the end.

### **5. Economically friendly and cheap.**

Because of huge material resource, price can be cheap after all.

### **6. Recyclable and biodegradable**

Because cellulose nanofiber is made from all natural resources, they are very recyclable and biodegradable, very environmentally friendly.

### **7. Other features**

High absorbing ability

High surface area

Edible

Biocompatible.

### **8. Application**

**A. Mix with plastic, resin (can be applied to parts for car, automotive, airplane, architecture etc...)**

- B. Strengthen various types of plastic, resin, thermoplastic while weight can be lighter**
- C. Filter**
- D. Transparent thin conductive thin film for EL display, Solar cell**
- E. Separator for lithium ion battery**
- F. Support body for catalyst**
- G. Artificial blood vessel, ligaments (Bio medical use)**
- H. Food additive**
- I. Cosmetic products**
- J. Smoothing, reinforcing for paper**

We can supply you in the form of cellulose nanofiber (CNF) in water dispersion. Also, cellulose nanofiber in organic solvent is possible such as alcohol, pyrrolidone based solvent, ethylene glycol based solvent (propylene glycol monomethylether, butyl cellosolve etc...). We can also try making CNF dispersion in some other organic solvent as customer requests). For example, below table indicates the basic property of FUJI SP CNF series.

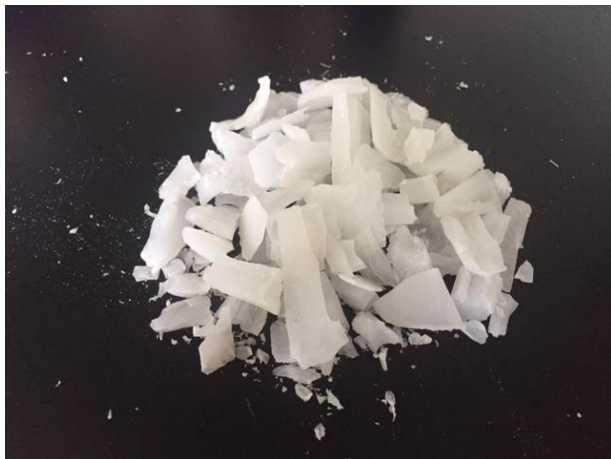
<b>CNF</b>	<b>0.2 - 5 %</b>
<b>Additive and Resin</b>	<b>0.01 - 0.5 %</b>
<b>Water</b>	<b>95.0 - 99.0 %</b>
<b>Viscosity</b>	<b>1.0 – 300000 mPa·s/ 25 °C (can be modified depends on customer request and purpose)</b>
<b>CNF size (diameter)</b>	<b>20.0 nm – 500.0 nm</b>



Moreover, we also supply CNF composite materials (masterbatch), mixed with polyethylene (PE), polypropylene (PP), poly vinyl chloride (PVC), acrylic resin, polyester resin etc...the concentration of CNF is 3-10 % although trying to develop to mix higher CNF concentration. Moreover, we are trying to create CNF composite masterbatch with PS, ABS etc... on

top of that, composite masterbatch with biodegradable plastic such as PLA, PBS etc...

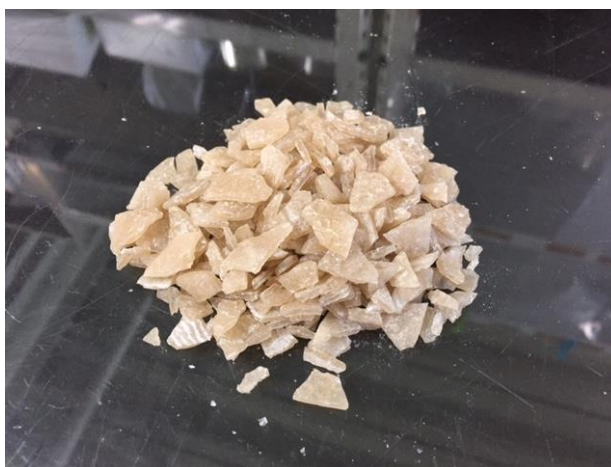
Please consult with us technical detail anytime.



**CNF composite PE masterbatch**



**CNF composite PVC masterbatch**



**CNF composite Acrylic masterbatch**