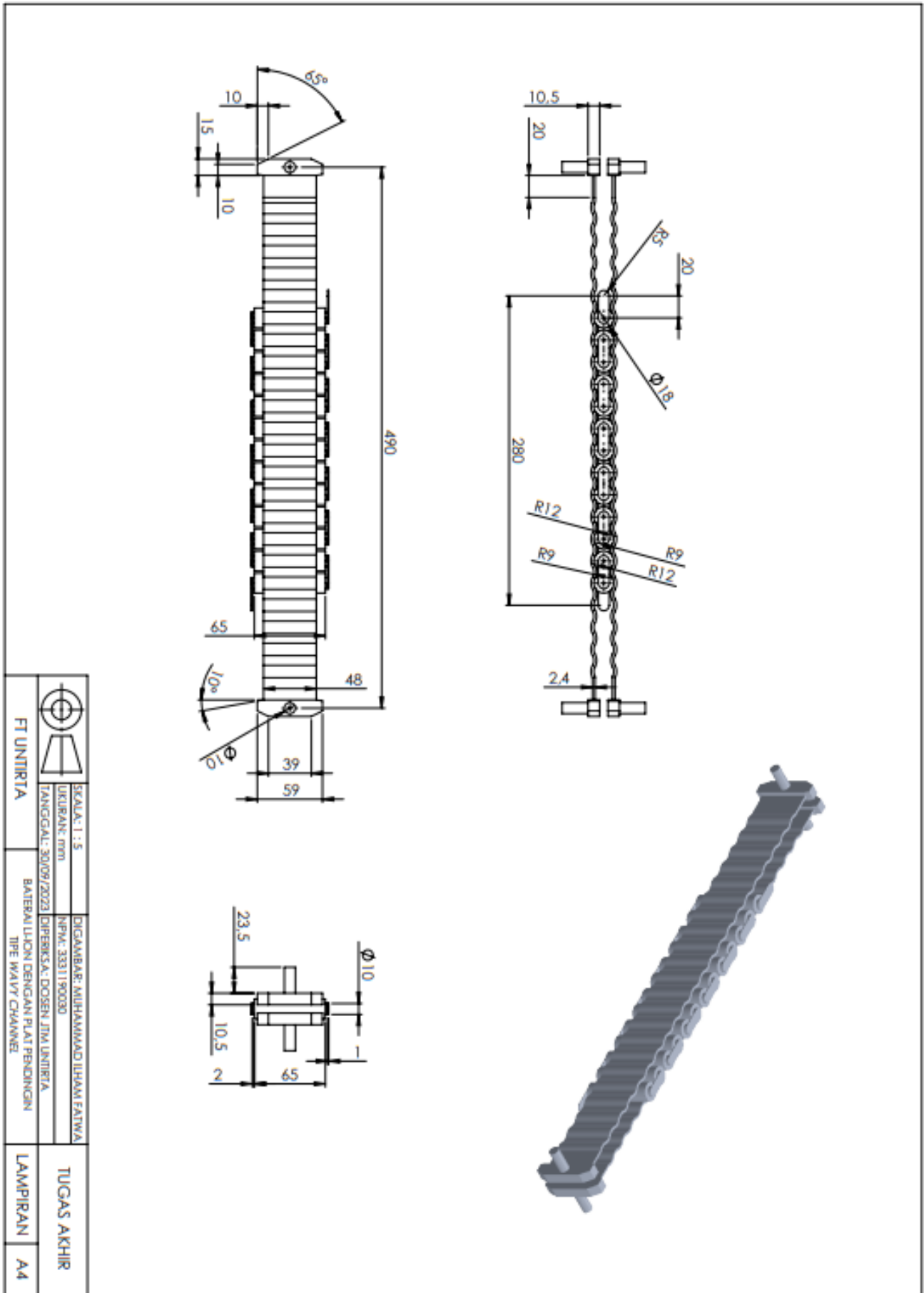


LAMPIRAN

Lampiran 1. Gambar Modul Baterai Li-Ion Dengan *Wavy Channel Tube*



Lampiran 2. Data Spesifikasi Pembelian Baterai Lithium-Ion

<https://shope.ee/LKiw2W609>



Spesifikasi

Stok, Masa Garansi, J... >

Deskripsi

Toko : KROYO SHOP

Tipe Baterai : 18650

Seri : Li-ion

Daya : 3000mAh

Voltase : 3.7volt

Warna : UNGU

Isi : 4 Pics Baterai

Jenis : Rata/ Flattop

Panjang ; 6.5cm

Lebar : 1.8cm

Harga Untuk 4 pcs Baterai

Bisa di isi Ulang

Produk di jamin 100% baru

Biasa di pakai untuk .MIC WIRELES, POWER BANK, VAPE, DLL

PERHATIAN..

Sebelum pemesanan Harap samakan tipe beteraai dengan perangkat yang anda miliki, dan kami tidak menerima komplain atas kesalahan pesanan dari costamer sendiri
Bila ada kesalahan pengiriman produk,atau kekurangan quantity Silahkan chat admin kita ,dan kami tidak akan menerima komplain jika telah memberi bintang1 dan penilaian buruk di ulasan
Dan Wajib di ikut sertakan vidio unboxing / vidio paket pas penerimaan barang dari kurir
terima kasih

Untuk produk sendiri di jamin 100% real picr dan ready akan stock,

Dan untuk produk yang akan di kirim kami selalu melakukan pengecekan

dan memastikan produk sudah berfungsi dengan baik

Lampiran 3. Perhitungan Persentase *Error*

Perhitungan persentase *error* dari hasil simulasi dilakukan dengan membandingkannya terhadap hasil eksperimen. Persentase *error* ini hanya dihitung pada modul baterai tanpa fluida pendingin untuk mengetahui parameter baterai yang digunakan sesuai.

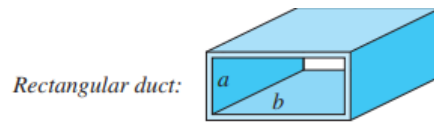
$$\begin{aligned}\% \text{ Error} &= \frac{\text{Hasil Eksperimen} - \text{Hasil Simulasi}}{\text{Hasil Eksperimen}} \times 100\% \\ &= \frac{47,87 \text{ }^{\circ}\text{C} - 46,7 \text{ }^{\circ}\text{C}}{47,87 \text{ }^{\circ}\text{C}} \times 100\% \\ &= 2,44\%\end{aligned}$$

Lampiran 4. Perhitungan Bilangan Reynolds

Bergantung pada kondisi alirannya, aliran dalam *tube* dapat bersifat laminar atau turbulen. Sebagian besar kondisi praktis, aliran dalam *tube* bersifat laminar untuk $Re < 2300$, transisi $2300 < Re < 4000$, dan turbulen > 4000 . (Cengel & Ghajar, 2015). Berikut persamaan dalam mencari bilangan Re:

$$Re = \frac{\rho \cdot v \cdot D}{\mu}$$

Dalam model simulasi, *duct* dari fluida berupa *wavy channel* dengan tipe *rectangular duct*, maka nilai D didapat dari *hydraulic diameter* (D_h). Nilai D_h pada *rectangular duct*, didapat dengan persamaan:



$$D_h = \frac{4ab}{2(a+b)} = \frac{2ab}{a+b}$$

$$D_h = \frac{2ab}{a+b} = \frac{2(0,0015)(0,049)}{(0,0015 + 0,049)} = 0,0029 \text{ m}$$

Pada persamaan Re dibutuhkan kecepatan fluida (v), maka laju aliran massa $5 \times 10^{-4} \text{ kg/s}$, $10 \times 10^{-4} \text{ kg/s}$, dan $15 \times 10^{-4} \text{ kg/s}$ diubah menjadi kecepatan fluida (v). Persamaan untuk mengubah laju aliran massa menjadi kecepatan adalah:

$$Q = \frac{V}{t} = A \cdot v \rightarrow V = A \cdot v \cdot t \quad ; \quad \rho = \frac{m}{V} \rightarrow V = \frac{m}{\rho}$$

$$\frac{m}{\rho} = A \cdot v \cdot t \rightarrow \frac{m}{t} = A \cdot v \cdot \rho \rightarrow \dot{m} = A \cdot v \cdot \rho \rightarrow \dot{m} = a \cdot b \cdot v \cdot \rho$$

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho}$$

A. Air

- Laju aliran massa $5 \times 10^{-4} \text{ kg/s}$

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho} = \frac{5 \times 10^{-4} \text{ kg/s}}{(0,0015 \text{ m}) \cdot (0,049 \text{ m}) \cdot (998,2 \text{ kg/m}^3)} = 0,0068 \text{ m/s}$$

$$Re = \frac{\rho \cdot v \cdot D}{\mu} = \frac{(998,2 \text{ kg/m}^3) \cdot (0,0068 \text{ m/s}) \cdot (0,0029 \text{ m})}{0,001003 \text{ kg/(m} \cdot \text{s)}}$$

$$Re = 19,62 \text{ (Laminar)}$$

- Laju aliran massa 10×10^{-4} kg/s

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho} = \frac{10 \times 10^{-4} \text{ kg/s}}{(0,0015 \text{ m}) \cdot (0,049 \text{ m}) \cdot (998,2 \text{ kg/m}^3)} = 0,0136 \text{ m/s}$$

$$Re = \frac{\rho \cdot v \cdot D}{\mu} = \frac{(998,2 \text{ kg/m}^3) \cdot (0,0136 \text{ m/s}) \cdot (0,0029 \text{ m})}{0,001003 \text{ kg/(m} \cdot \text{s)}}$$

$$Re = 39,25 \text{ (Laminar)}$$

- Laju aliran massa 15×10^{-4} kg/s

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho} = \frac{15 \times 10^{-4} \text{ kg/s}}{(0,0015 \text{ m}) \cdot (0,049 \text{ m}) \cdot (998,2 \text{ kg/m}^3)} = 0,02 \text{ m/s}$$

$$Re = \frac{\rho \cdot v \cdot D}{\mu} = \frac{(998,2 \text{ kg/m}^3) \cdot (0,02 \text{ m/s}) \cdot (0,0029 \text{ m})}{0,001003 \text{ kg/(m} \cdot \text{s)}}$$

$$Re = 57,72 \text{ (Laminar)}$$

B. Air 60% + Etilen Glikol 40%

- Laju aliran massa 5×10^{-4} kg/s

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho} = \frac{5 \times 10^{-4} \text{ kg/s}}{(0,0015 \text{ m}) \cdot (0,049 \text{ m}) \cdot (1051,5 \text{ kg/m}^3)} = 0,0064 \text{ m/s}$$

$$Re = \frac{\rho \cdot v \cdot D}{\mu} = \frac{(1051,5 \text{ kg/m}^3) \cdot (0,0064 \text{ m/s}) \cdot (0,0029 \text{ m})}{0,0021 \text{ kg/(m} \cdot \text{s)}}$$

$$Re = 9,3 \text{ (Laminar)}$$

- Laju aliran massa 10×10^{-4} kg/s

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho} = \frac{10 \times 10^{-4} \text{ kg/s}}{(0,0015 \text{ m}) \cdot (0,049 \text{ m}) \cdot (1051,5 \text{ kg/m}^3)} = 0,013 \text{ m/s}$$

$$Re = \frac{\rho \cdot v \cdot D}{\mu} = \frac{(1051,5 \text{ kg/m}^3) \cdot (0,013 \text{ m/s}) \cdot (0,0029 \text{ m})}{0,0021 \text{ kg/(m} \cdot \text{s)}}$$

$$Re = 18,88 \text{ (Laminar)}$$

- Laju aliran massa 15×10^{-4} kg/s

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho} = \frac{15 \times 10^{-4} \text{ kg/s}}{(0,0015 \text{ m}) \cdot (0,049 \text{ m}) \cdot (1051,5 \text{ kg/m}^3)} = 0,019 \text{ m/s}$$

$$Re = \frac{\rho \cdot v \cdot D}{\mu} = \frac{(1051,5 \text{ kg/m}^3) \cdot (0,019 \text{ m/s}) \cdot (0,0029 \text{ m})}{0,0021 \text{ kg/(m} \cdot \text{s)}}$$

$$Re = 27,59 \text{ (Laminar)}$$

C. Nanofluida Cellulose Nanocrystal (CNC) – Air (W) + Etilen Glikol (EG)

- Laju aliran massa 5×10^{-4} kg/s

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho} = \frac{5 \times 10^{-4} \text{ kg/s}}{(0,0015 \text{ m}) \cdot (0,049 \text{ m}) \cdot (1052,3 \text{ kg/m}^3)} = 0,0065 \text{ m/s}$$

$$Re = \frac{\rho \cdot v \cdot D}{\mu} = \frac{(1052,3 \text{ kg/m}^3) \cdot (0,0065 \text{ m/s}) \cdot (0,0029 \text{ m})}{0,00223 \text{ kg/(m} \cdot \text{s)}}$$

$$Re = 8,9 \text{ (Laminar)}$$

- Laju aliran massa 10×10^{-4} kg/s

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho} = \frac{10 \times 10^{-4} \text{ kg/s}}{(0,0015 \text{ m}) \cdot (0,049 \text{ m}) \cdot (1052,3 \text{ kg/m}^3)} = 0,013 \text{ m/s}$$

$$Re = \frac{\rho \cdot v \cdot D}{\mu} = \frac{(1052,3 \text{ kg/m}^3) \cdot (0,013 \text{ m/s}) \cdot (0,0029 \text{ m})}{0,00223 \text{ kg/(m} \cdot \text{s)}}$$

$$Re = 17,8 \text{ (Laminar)}$$

- Laju aliran massa 15×10^{-4} kg/s

$$v = \frac{\dot{m}}{a \cdot b \cdot \rho} = \frac{15 \times 10^{-4} \text{ kg/s}}{(0,0015 \text{ m}) \cdot (0,049 \text{ m}) \cdot (1052,3 \text{ kg/m}^3)} = 0,02 \text{ m/s}$$

$$Re = \frac{\rho \cdot v \cdot D}{\mu} = \frac{(1052,3 \text{ kg/m}^3) \cdot (0,02 \text{ m/s}) \cdot (0,0029 \text{ m})}{0,00223 \text{ kg/(m} \cdot \text{s)}}$$

$$Re = 27,37 \text{ (Laminar)}$$

Lampiran 5. Cellulose Nanocrystal (CNC) Data Sheet



Technical Data Sheet

CelluForce NCC® NCV100-NASD90

Description

CelluForce NCC® NCV100-NASD90 which is extracted from cellulose, the main building block of trees and plants, is a redispersible powder of uniform acyclic nanometric crystals. Their size, shape, and charge lead to unique behavior in suspensions. The high chemical reactivity of the crystal surfaces makes CelluForce NCC customizable for various applications.

Features and Benefits

- Bio-based and readily biodegradable
- Non-irritating and non-toxic
- High temperature stability
- Thickens fluids and suspends other particles
- Stabilises emulsions and foams
- Forms impermeable barriers
- Strengthens structures
- Lubricates surfaces

Typical Properties

Property	Unit	Result
Product Form		Spray dried powder
Appearance (color)		White to Off-White Powder
Density	g.cm ⁻³	0.4 - 0.6
Moisture content	wt. %	≤ 6
Particle Size (powder)	µm	1 - 50
Particle size ¹	nm	< 150
Conductivity ¹	µS.cm ⁻¹	< 350
pH ¹		5.0 - 8.0
Viscosity ¹	mPa.s	> 5
Shelf Life	year	4

¹Analysis made on dispersed powder at 2wt% in deionized water

How to use

CelluForce NCC®, an easy-to-use powder, is hydrophilic and can be easily incorporated into water or the aqueous phase of an emulsion. Please contact CelluForce for specific guidance.

Usable Life and Storage

This product has a 4-year shelf life after the production date for an unopened container.

Store at room temperature and away from ignition sources. Store in dry conditions with relative humidity < 50%.

Health and Environmental Information

Product safety, health and environmental information is not included in this document. Please read the safety datasheet for the relevant information. To support customers in their product safety needs, CelluForce has product stewardship, safety, and regulatory resources available to assist our customers.

Disposal

Dispose container and unused contents in accordance with federal, provincial/territorial, and local requirements.

NOTICE: CelluForce assumes no responsibility for the information contained in this document. NO WARRANTY IS GIVEN; ALL IMPLIED WARRANTIES OF QUALITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

Section 1: Identification of the substance/mixture and of the company/undertaking**1.1. Product identifier**

Trade Name: CelluForce NCC® NCV100-NASD90
Synonyms: Cellulose nanocrystals; Nanocrystalline cellulose; NCV102-NASD90.
Product Code: Not available.

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Rheology modifier, strengthening agent, suspending agent, film former.
Uses advised against: Not available.

1.3. Details of the supplier of the safety data sheet

Name: CelluForce Inc.
Address: 609 Rang 12 C.P. 3
Windsor, QC, J1S 2L7
Canada
Phone Number: +1 (514) 360-1023
E-mail of competent person responsible for SDS in the EU: info@celluforce.com

1.4. Emergency telephone number:

Emergency Phone: +1 (819) 481-0529 ext. 52804 (Mon-Fri / 8 AM - 5 PM (GMT-5))

Section 2: Hazards identification**2.1. Classification of the substance or mixture****2.1.1. Classification according to CLP (Regulation (EC) No 1272/2008)**

CLP Classification: Not hazardous according to CLP (Regulation (EC) No 1272/2008) criteria.

2.1.3 Additional information:

For full text of Hazard- and EU Hazard-statements: see SECTION 16.

2.2. Label elements**Labelling according to CLP (Regulation (EC) No 1272/2008)**

Hazard None.
Pictogram(s):
Signal Word: None.
Hazard Statements: Not applicable.

Precautionary Statements
Prevention: Not applicable.

Response: Not applicable.

Storage: Not applicable.

Disposal: Not applicable.

2.3. Other hazards

Not Classified as PBT/vPvB by EU criteria.

Section 3: Composition / information on ingredients
3.2. Mixtures

Ingredient(s)	CAS No.	EC No.	Wt. %	Classification according to Regulation (EC) No 1272/2008 (CLP) ⁺
Cellulose, nanocrystalline	9004-34-6	232-674-9	80 - 100	Not hazardous.

⁺ See section 16 for the full text of the hazard phrases. Occupational exposure limits, if available, are listed in section 8.

Section 4: First aid measures
4.1. Description of first aid measures

Inhalation:	If inhaled: Call a poison center or doctor if you feel unwell.
Eye Contact:	If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a poison center or doctor if you feel unwell.
Skin Contact:	If on skin: Wash with plenty of water. Call a poison center or doctor if you feel unwell.
Ingestion:	If swallowed: Call a poison center or doctor if you feel unwell. If vomiting occurs naturally, have victim lean forward to reduce the risk of aspiration. Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.

4.2. Most important symptoms and effects, both acute and delayed

Inhalation:	No adverse effects are anticipated from single exposure to mist. Inhalation of large amounts of dust may cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.
Eye Contact:	May cause eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.
Skin Contact:	Brief contact is essentially non-irritating to skin. (Primary irritation index: 0.0) Prolonged skin contact is unlikely to result in absorption of harmful amounts.
Ingestion:	Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.

4.3. Indication of any immediate medical attention and special treatment needed

Note to Physicians: Symptoms may not appear immediately.

Section 5: Firefighting measures**5.1. Extinguishing media**

Suitable Extinguishing Media: Small Fire: Dry chemical, CO₂, water spray or regular foam.

Large Fire: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk.

Unsuitable Extinguishing Media: Not available.

5.2. Special hazards arising from the substance or mixture

Hazardous combustion products: Oxides of carbon.

5.3. Advice for firefighters

Protection of Firefighters: May form combustible dust concentrations in air.
Fire may produce irritating, corrosive and/or toxic gases.
Runoff from fire control or dilution water may cause pollution.
Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection.

Section 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

6.1.1. For non-emergency personnel: Do not touch or walk through spilled material. Use personal protection recommended in Section 8. Keep away from heat, sparks and flame. Keep container closed (and grounded). Prevent dust accumulation (to minimize explosion hazard).

6.1.2. For emergency responders: Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).

6.2. Environmental precautions

Keep out of drains, sewers, ditches, and waterways.

6.3. Methods and material for containment and cleaning up

6.3.1. Methods for Containment: Do not flush to sewer or allow to enter waterways.

6.3.2. Methods for Clean-Up: Use explosion-proof equipment. Dust can be a fire or explosion hazard. Sweep up and shovel into suitable containers for disposal. Cleaning methods (e.g. compressed air) which can generate potentially combustible dust clouds should not be used.

6.3.3. Other Information: Dispose of contents and container according to applicable regional, national and local regulations.

6.4. Reference to other sections

See Section 8 for occupational exposure limits and risk management measures. Refer to Section 13 for disposal considerations.

Section 7: Handling and storage**7.1. Precautions for safe handling**

Minimize dust generation and accumulation. Airborne dusts are potentially explosive. Avoid significant deposits of material, especially on horizontal surfaces, which may become airborne and form combustible dust clouds and may contribute to secondary explosions. Handling and processing operations should be conducted in accordance with 'best practices' (e.g. NFPA-654). Dry powders can build static electricity charges when subjected to the friction of transfer and mixing operations. To avoid fire or explosion, ground and bond container and receiving equipment (and ground personnel) before transferring material. Do not swallow. See Section 8 for information on Personal Protective Equipment.

7.2. Conditions for safe storage, including any incompatibilities

Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Store away from incompatible materials. See Section 10 for information on Incompatible Materials. Keep out of the reach of children.

7.3. Specific end use(s)

No specific instructions required.

Section 8: Exposure controls / personal protection**8.1. Control parameters**

Cellulose, nanocrystalline [CAS No. 9004-34-6]

ACGIH: 10 mg/m³ (TWA); (1985)

MAK: No MAK established.

WEL: 10 mg/m³ (TWA) (Inhalable); 4 mg/m³ (TWA) (Respirable); 20 mg/m³ (STEL) (Inhalable)

VLEP: 10 mg/m³ (VLEP 8h); (1987)

TWA: Time-Weighted Average

STEL: Short-Term Exposure Limit

MAK: Maximale Arbeitsplatzkonzentrationen (Maximum workplace concentrations)

WEL: Workplace Exposure Limit

VLEP: Valeurs limites d'exposition professionnelle (Occupational exposure limit values)

8.2. Exposure controls**8.2.1. Appropriate Engineering Controls:**

It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion suppression system or an oxygen-deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use explosion-proof electrical, ventilating, and lighting equipment.

8.2.2. Personal Protection Equipment


Eye/Face Protection:	Wear safety glasses. Use equipment for eye protection according to European Standard EN 166.
Skin Protection:	
Hand Protection:	Wear protective gloves. Consult manufacturer specifications for further information.
Body Protection:	Wear protective clothing.
Respiratory Protection:	If engineering controls and ventilation are not sufficient to control exposure to below the allowable limits then a half mask particulate respirator (NIOSH type N95 or better filters) must be worn. Supplied air breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.
Thermal Hazards:	Not applicable.
General Hygiene Considerations:	Handle according to established industrial hygiene and safety practices. Consult a competent industrial hygienist to determine hazard potential and/or the PPE manufacturers to ensure adequate protection.

8.2.3. Environmental exposure controls:

Follow all applicable environmental protection legislation.

Section 9: Physical and chemical properties

Appearance:	White crystalline powder.
Odour:	Odourless.
Odour Threshold:	Not available.
Physical State:	Liquid.
pH (2% dispersion in water):	5 to 8 at 25 °C (77 °F)
Particle characteristic:	Microform (nanoform once dispersed in water).
Particle size distribution (volume weighted):	d(0.1) ≥ 0.1 µm (Cellulose, nanocrystalline) d(0.9) ≤ 50 µm (Cellulose, nanocrystalline)
Particle Shape (once dispersed in water):	Sticks.
Primary particle size (crystallite):	Mean Length: 76 nm (Cellulose, nanocrystalline) Mean Width: 3.4 nm (20:1 ratio) (Cellulose, nanocrystalline)
Specific surface area (crystallite):	500 m ² /g (Cellulose, nanocrystalline)
Crystallinity:	88% by x-ray diffraction (Cellulose, nanocrystalline)

Surface functionalization/treatment:	Not applicable.
Melting Point / Freezing Point:	Not available.
Initial Boiling Point:	Not available.
Boiling Point:	Not available.
Flash Point:	Not available.
Evaporation Rate:	Not available.
Flammability (solid, gas):	See Section 5. May form combustible dust concentrations in air.
Lower Flammability Limit:	Not available.
Upper Flammability Limit:	Not available.
Vapour Pressure:	Not available.
Vapour Density:	Not available.
Relative Density:	Not available.
Solubilities:	Dispersible in water.
Partition Coefficient: n-Octanol/Water:	Not available.
Auto-ignition Temperature:	410 °C (770 °F)
Decomposition Temperature:	Not available.
Viscosity:	Not available.
Explosive Properties:	Not available.
Oxidising Properties:	Not considered as oxidising.
Bulk Density:	0.7 g/cc
Weight Percent < 1,000 Daltons:	0.6
Weight Percent < 500 Daltons:	<0.1
Coefficient of Water/Oil Distribution:	Not available.
Minimum Ignition Energy, MIE:	55 mJoule (ASTM E2019)
Dust Deflagration Index, Kst:	185 bar·m/s (ST class 1) (ASTM E1226)
Pmax:	8.8 bar (128 psig) (ASTM E1226)

Section 10: Stability and reactivity

10.1. Reactivity

Contact with incompatible materials. Sources of ignition. Exposure to heat. Flowing product can create electrical charge, resulting sparks may ignite dust or cause an explosion in some concentration ranges.

10.2. Chemical stability

Stable under normal storage conditions.

- 10.3. Possibility of hazardous reactions** A high concentration of dust may form an explosive mixture in air.
- 10.4. Conditions to avoid** Contact with incompatible materials. Sources of ignition. Exposure to heat. Avoid dust formation and deposits.
- 10.5. Incompatible materials** Strong oxidizers. Generated dust may ignite at temperatures in excess of 400 °C (752 °F).
- 10.6. Hazardous decomposition products** Not available.

Section 11: Toxicological information
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11.1. Information on toxicological effects
Acute Toxicity:

- Inhalation:** No adverse effects are anticipated from single exposure to mist. Inhalation of large amounts of dust may cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.
- Eye:** May cause eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.
- Skin:** Brief contact is essentially non-irritating to skin. (Primary irritation index: 0.0)
Prolonged skin contact is unlikely to result in absorption of harmful amounts.
- Ingestion:** Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.

Component	CAS No.	LD ₅₀ oral	LD ₅₀ dermal	LC ₅₀ inhalation
Cellulose, nanocrystalline	9004-34-6	> 3160 mg NCC/kg (rat)	> 2000 mg/kg (rabbit)	> 5800 mg/m ³ (rat); 4H

- Skin corrosion / irritation:** Not expected to cause skin irritation.
- Serious eye damage/irritation:** Not expected to cause eye irritation.
- Respiratory or skin sensitisation:** Not expected to cause respiratory or skin sensitisation.
- Germ cell mutagenicity:** Not mutagenic at 5 mg NCC/plate to *S. typhimurium* strains TA98, TA100, TA1535, TA1537 and *E. coli* strain WP2 uvrA. Does not induce chromosome aberration at 5 mg NCC/mL in cultured WBL Chinese hamster ovary cells. No effect in mouse micronucleus test at 2,000 mg NCC/kg.
- Carcinogenicity:** This product does not contain any carcinogens or potential carcinogens above reportable thresholds as listed by ACGIH, IARC, OSHA, or NTP.
- Reproductive toxicity:** Not available.
- STOT-single exposure:** Not available.

SAFETY DATA SHEET according to 1907/2006/EC (REACH) and 1272/2008/EC (CLP) and their amendments

STOT-repeated exposure: Not available.
Aspiration hazard: Not an aspiration hazard.
Chronic Effects: Prolonged or repeated contact may dry skin and cause irritation.
Other information on adverse health effects: No other adverse effects expected.

Section 12: Ecological information

<u>12.1. Toxicity</u>	Acute lethal toxicity fish – Rainbow trout (Oncorhynchus mykiss) (96-h) LC50: > 10 g NCC/L; Acute lethal toxicity invertebrate – Daphnia magna (48-h) LC50: > 1 g NCC/L Ceriodaphnia dubia (48-h) LC50: > 1 g NCC/L; Chronic, sublethal growth inhibition algae – Pseudokirchneriella (Raphidocelis) subcapitata (72-h) IC25: > 2.5 g NCC/L; Chronic, sublethal reproduction inhibition invertebrates – C. dubia (7-d) IC25: > 1 g NCC/L.
<u>12.2. Persistence and degradability</u>	Ready biodegradability: 42%.
<u>12.3. Bioaccumulative potential</u>	Not available.
<u>12.4. Mobility in soil</u>	Not available.
<u>12.5. Results of PBT and vPvB assessment</u>	Not applicable.
<u>12.6. Other adverse effects</u>	Not available.

Section 13: Disposal considerations
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13.1. Waste treatment methods

Disposal Instructions: Disposal should be in accordance with applicable regional, national and local laws and regulations. Local regulations may be more stringent than regional or national requirements.

Section 14: Transport information
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ADR / RID

<u>14.1. UN number:</u>	Not applicable.
<u>14.2. UN proper shipping name:</u>	Not regulated.
<u>14.3. Transport hazard class(es):</u>	Not applicable.
<u>14.4. Packing group:</u>	Not applicable.
<u>14.5. Environmental hazards:</u>	Not applicable.
<u>14.6. Special precautions for user:</u>	Not available.
<u>14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:</u>	Not applicable.

Section 15: Regulatory information**15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture**

Authorisations: Not applicable.
Restrictions on use: Use only as intended.
Other EU regulations: Not available.
National regulations: Not applicable.

15.2. Chemical safety assessment

Chemical Safety Assessment: No Chemical Safety Assessments have been carried out for this substance.

Section 16: Other information

Classification and procedure used to derive the classification for mixtures according to Regulation (EC) 1272/2008 [CLP]:

Classification according to Regulation (EC) No 1272/2008

Not hazardous.

Classification procedure

Self-classification.

Relevant H-statements (number and full text):

Not applicable.

Disclaimer:

The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for their own particular use.

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