

# "Virus-free"

## Electropositive Charged Filter



### ENVIONEER

### NANOPURE-Plus®

Usable with natural pressure

Make of human friendly water

What is the electropositive charged filter?

- Micro filter with 0.5 – 0.9  $\mu\text{m}$  mean pore size
- Electropositive charged on the surface of media and inside its pore
- Removing the organic and inorganic materials such as Virus, bacteria and Colloids

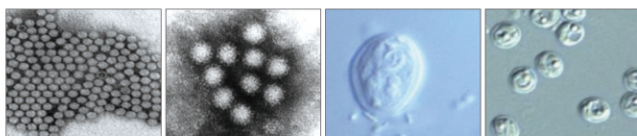
Virus? Bacteria?

- Virus is an infectious pathogen smaller than bacteria (size 10 – hundreds nm)
- Bacteria has the cell wall and proliferates by itself

Category	Bacteria	Virus
Size	Several micrometer ( $\mu\text{m}$ )	Hundreds nanometer (nm)
	Checking by general optical microscope	Checking by general electron microscope
Self-proliferation	Possible	Impossible Possible with host
Amount of pathogenesis	Hundreds ~ millions	Possible with small amount (10 - 100)
Cure	Antibiotics	No therapy & no vaccine
Secondary infection	X	O (Almost of all)

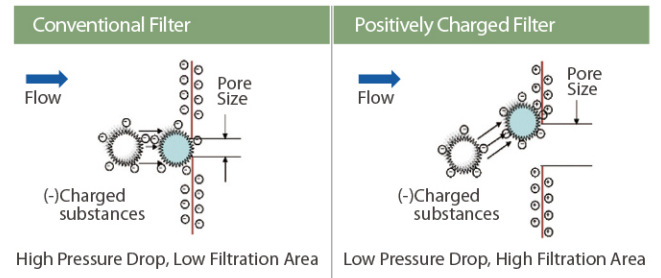
Importance of microorganisms in water

- In the late 1980s, it was come out as true that the pathogenic microorganisms such as Virus, Cryptosporidium, Giardia are the reason of waterborne diseases
- So most countries manage these microorganism as the standard of water purification
- But, these Protozoa & Virus have a tolerance of disinfection so it is not removed by the chlorine



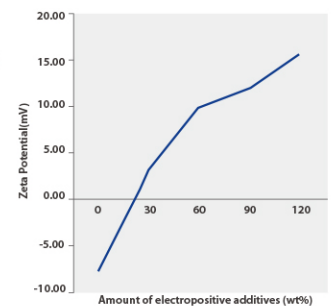
Mechanism of electropositive charge

- Almost all pollutants including microorganisms have electronegative (-) charge in the water
- Electropositive (+) charged media collects the (-) charge pollutants by electrostatic force on the surface of media and inside pore
- Coating the filter media fibers with cationic polymer binder resin



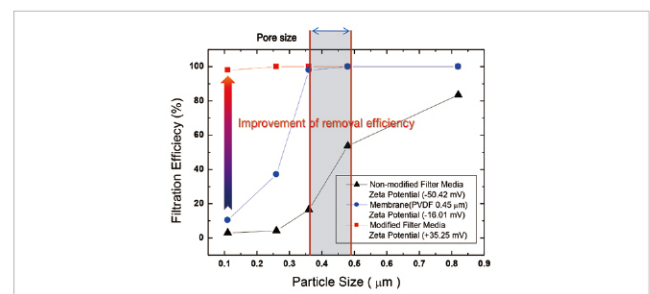
Measurement of electropositive charge

- Zeta potential shows the value(mV) of electropositive charge on the media
- Comparing with the Zeta potential, it evaluates the virus removal efficiency



Amount of electropositive additives (wt%)	Zeta potential (mV)	Noro Retention (%)
0	-7.91	90.000
30	2.75	99.000
60	9.64	99.997
90	11.93	99.999
120	15.6	99.999

Particle removal effects of electropositive charge



## Features of NANOPURE-Plus®

- High filtration efficiency and low pressure drop at high flow rate
- Removes virus and bacteria (Over 5 log Norovirus removal efficiency)
- Uses natural pressure, not motor pressure
- Allows use of nonwoven media that provides the filtration quality of membranes
- Provides the platform for new device that are smaller, less expensive and deliver high efficiency
- Can be used in all household water applications
- Various pore size grade filter media can be supplied
- Manufacturing of the filter assembly can be done by various types such as wounding and pleated types

## Virus removal performance of NANOPURE-Plus®

### Bottle Type Test

Accumulated Vol. of water (L, Approx.)	Raoultella terrigena (CFU/mL)			MS2 coliphage (PFU/mL)		
	Influent	Effluent	Log <sub>10</sub> Removal	Influent	Effluent	Log <sub>10</sub> Removal
100	2.5x10 <sup>6</sup>	7.3x10 <sup>0</sup>	5.53 (99.9997%)	1.3x10 <sup>6</sup>	7.3x10 <sup>2</sup>	3.26 (99.9447%)
200	1.1x10 <sup>6</sup>	2.7x10 <sup>0</sup>	5.60 (99.9997%)	1.4x10 <sup>6</sup>	1.4x10 <sup>3</sup>	3.00 (99.9000%)
300	1.2x10 <sup>6</sup>	6.0x10 <sup>0</sup>	5.28 (99.9995%)	6.9x10 <sup>5</sup>	6.9x10 <sup>2</sup>	3.06 (99.9124%)
400	2.0x10 <sup>6</sup>	1.7x10 <sup>0</sup>	6.09 (99.9999%)	1.4x10 <sup>6</sup>	1.0x10 <sup>3</sup>	3.14 (99.9278%)

※ Detection methods : NSF Protocol P248 / EPA method 1602 (Double agar layer)

### Dispenser Type Test

Accumulated Vol. of water (L, Approx.)	Raoultella terrigena (CFU/mL)			MS2 coliphage (PFU/mL)		
	Influent	Effluent	Log <sub>10</sub> Removal	Influent	Effluent	Log <sub>10</sub> Removal
50	1.4x10 <sup>5</sup>	ND	>5.55 (100%)	3.0x10 <sup>5</sup>	ND	>5.87 (100%)
100	1.1x10 <sup>5</sup>	ND	>5.45 (100%)	4.1x10 <sup>5</sup>	ND	>6.01 (100%)
200	2.8x10 <sup>5</sup>	3.0x10 <sup>0</sup>	4.96 (99.9989%)	3.2x10 <sup>5</sup>	ND	>5.91 (100%)
300	1.6x10 <sup>5</sup>	8.0x10 <sup>0</sup>	4.30 (99.9950%)	4.0x10 <sup>5</sup>	ND	>6.00 (100%)
500	1.7x10 <sup>5</sup>	2.3x10 <sup>0</sup>	4.86 (99.9986%)	5.1x10 <sup>5</sup>	ND	>6.10 (100%)
1,000	1.0x10 <sup>6</sup>	1.4x10 <sup>2</sup>	3.88 (99.9867%)	1.8x10 <sup>6</sup>	ND	>6.66 (100%)

※ Detection methods : NSF Protocol P248 / EPA method 1602 (Double agar layer)

### Water purifier Type Test

Volume of water(L)	Ct value		Quantity (copy/carrier*)		Reduction rate	
	Influent	Effluent	Influent	Effluent	Percentage	Log <sub>10</sub>
2000	24.60	N/A	2.3X10 <sup>4</sup> 5	-	99.999	5.36
4000	24.31	N/A	2.8X10 <sup>4</sup> 5	-	99.999	5.45
6000	24.38	38.17	2.7X10 <sup>4</sup> 5	1.0X10 <sup>4</sup> 2	99.963	3.43

Test Conditions:

- 1) Microorganisms : Murine Norovirus (MNV-1)
- 2) Stock concentration: 10<sup>4</sup> PFU/ml
- 3) Flow rate: 0.2 LPM (Liter per minute)

## Product Safety Data

### ROHS test

SGS Test Report No. F0001012345678910111213141516171819202122232425262728293031323334353637383940414243444546474849505152535455565758596061626364656667686970717273747576777879808182838485868788899091929394959697989900010210310410510610710810911011111211311411511611711811912012112212312412512612712812913013113213313413513613713813914014114214314414514614714814915015115215315415515615715815916016116216316416516616716816917017117217317417517617717817918018118218318418518618718818919019119219319419519619719819920020120220320420520620720820921021121221321421521621721821922022122222322422522622722822923023123223323423523623723823924024124224324424524624724824925025125225325425525625725825926026126226326426526626726826927027127227327427527627727827928028128228328428528628728828929029129229329429529629729829930030130230330430530630730830931031131231331431531631731831932032132232332432532632732832933033133233333433533633733833934034134234334434534634734834935035135235335435535635735835936036136236336436536636736836937037137237337437537637737837938038138238338438538638738838939039139239339439539639739839940040140240340440540640740840941041141241341441541641741841942042142242342442542642742842943043143243343443543643743843944044144244344444544644744844945045145245345445545645745845946046146246346446546646746846947047147247347447547647747847948048148248348448548648748848949049149249349449549649749849950050150250350450550650750850951051151251351451551651751851952052152252352452552652752852953053153253353453553653753853954054154254354454554654754854955055155255355455555655755855956056156256356456556656756856957057157257357457557657757857958058158258358458558658758858959059159259359459559659759859960060160260360460560660760860961061161261361461561661761861962062162262362462562662762862963063163263363463563663763863964064164264364464564664764864965065165265365465565665765865966066166266366466566666766866967067167267367467567667767867968068168268368468568668768868969069169269369469569669769869970070170270370470570670770870971071171271371471571671771871972072172272372472572672772872973073173273373473573673773873974074174274374474574674774874975075175275375475575675775875976076176276376476576676776876977077177277377477577677777877978078178278378478578678778878979079179279379479579679779879980080180280380480580680780880981081181281381481581681781881982082182282382482582682782882983083183283383483583683783883984084184284384484584684784884985085185285385485585685785885986086186286386486586686786886987087187287387487587687787887988088188288388488588688788888989089189289389489589689789889990090190290390490590690790890991091191291391491591691791891992092192292392492592692792892993093193293393493593693793893994094194294394494594694794894995095195295395495595695795895996096196296396496596696796896997097197297397497597697797897998098198298398498598698798898999099199299399499599699799899910001001100210031004100510061007100810091010101110121013101410151016101710181019102010211022102310241025102610271028102910301031103210331034103510361037103810391040104110421043104410451046104710481049105010511052105310541055105610571058105910601061106210631064106510661067106810691070107110721073107410751076107710781079108010811082108310841085108610871088108910901091109210931094109510961097109810991100110111021103110411051106110711081109111011111112111311141115111611171118111911201121112211231124112511261127112811291130113111321133113411351136113711381139114011411142114311441145114611471148114911501151115211531154115511561157115811591160116111621163116411651166116711681169117011711172117311741175117611771178117911801181118211831184118511861187118811891190119111921193119411951196119711981199120012011202120312041205120612071208120912101211121212131214121512161217121812191220122112221223122412251226122712281229123012311232123312341235123612371238123912401241124212431244124512461247124812491250125112521253125412551256125712581259126012611262126312641265126612671268126912701271127212731274127512761277127812791280128112821283128412851286128712881289129012911292129312941295129612971298129913001301130213031304130513061307130813091310131113121313131413151316131713181319132013211322132313241325132613271328132913301331133213331334133513361337133813391340134113421343134413451346134713481349135013511352135313541355135613571358135913601361136213631364136513661367136813691370137113721373137413751376137713781379138013811382138313841385138613871388138913901391139213931394139513961397139813991400140114021403140414051406140714081409141014111412141314141415141614171418141914201421142214231424142514261427142814291430143114321433143414351436143714381439144014411442144314441445144614471448144914501451145214531454145514561457145814591460146114621463146414651466146714681469147014711472147314741475147614771478147914801481148214831484148514861487148814891490149114921493149414951496149714981499150015011502150315041505150615071508150915101511151215131514151515161517151815191520152115221523152415251526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