

membranuli teqnologiebis sainJinro instituti

2013 wlis
samecniero angariSi

institutis direqtori – g. bibileiSvili

samecniero erTeulis personaluri Semadgenloba:

#	saxeli, gvარი	Tanamdebobis dasaxeleba	struqturuli danayofi
1	giorgi bibileiSvili	direqtori	administracia
2	nana svaniZe	mTavari specialisti	-
3	gurami buTxuzi	specialisti	-
4	leila TananaSvili	swavluli mdivani	-
5	karlo domianiZe	struqt.erT.xelmZRvaneli	membranuli procesebis kvlevis ganyofileba
6	daviT saTiriSvili	mecnier TanamSromeli	-
7	nino mumlaZe	mecnier TanamSromeli	-
8	dodo abulaZe	ufrosi laboranti	-
9	tereza TodaZe	laboranti	-
10	neli vardiaSvili	teqnikosi	-
11	elene kakabaZe	struqt.erT.xelmZRvaneli	membranuli teqnologiisa da teqnikis damuSavebis ganyofileba
12	liana yufaraZe	mecnier TanamSromeli	-
13	arCil gasitaSvili	mecnier TanamSromeli	-
14	JuJuna sulxaniSvili	inJ.-konstruqtori	-
1	ira jalaRania	inJ.-konstruqtori	-

5			
1 6	qeTevan kavTuaSvili	ufrosi laboranti	-
1 7	anzor namoraZe	laboranti	-
1 8	lamara kvintraZe	teqnikosi	-

**saqarTvelos saxelmwifo biujetis dafinansebiT 2013 wlisaTvis
dagegmili da Sesrulebuli samecniero-kvleviT samuSaoebi**

#	samuSaos dasaxeleba	samuSaos xelmZRvaneli	samuSaos Semsruleblebi
1	ultra- da nanofiltraciuli baromembranuli procesebis kombinirebuli meTodis kvleva sasmeli wylis nawilobrivi (1.5 – 3.5 mg-eqv/l) demineralizaciisTvis	g. bibileiSvili	membranuli procesebis kvlevის ganyofileba, xelmZRvaneli-k.domianiZe

bunebrivi da wyalgayvanilobis wylis gawmenda, sterilizacia, saWiro doneze gamtknareba (demineralizacia) gansakuTrebiT mniSvnelovania ara marto sayofacxovrebo pirobebSi, aramed saswavlo, samkurnalo, profilaqtikur da sakvlev-samedicino dawesebulebeSi.

mikrofiltraciuli, ultrafiltraciuli, nanofiltraciuli da ukuosmosuri procesebis gamoyenebiT membranuli nanoteqnologiebisa da nanosistemebis damuSaveba, Seqmna da wyalmomzadebis mimarTulebiT sawarmoo danergva saSualebas iZleva uzrunvelyoT sabavSvo baRebi, saganmanaTleblo (skolebi, umaRlesi saswavleblebi) da samedicino dawesebulebebi steriluri, saWiro doneze demineralizebuli sasmeli wylis miRebis samamulo warmoebis aparaturiT. energetikis, farmacevtiuli, samxedro, qimiuri da kvebis mrewvelobisaTvis gardamavali (nawilobrivi demineralizebuli), distilirebuli, teqnologiuri da zesufTa wylis miRebis srulad avtomatizirebuli, adgilobrivi warmoebis membranuli aparatura saTanado nanoteqnologiit.

wina wlis TematikiT gaTvaliswinebuli iyo wylis im doneze damuSaveba, romelic uzrunvelyofs granulometriuli zomebis moxedviT koloiduri da Sewonili nawilakebis mTliani speqtrisa da baqteriebis, riketsiebis, virusebisa da mcnareuli warmoSobis erTi an mravalujrediani mikroorganizmebis 100%-iT mocilebas, rac baromembranuli procesiT Seesabameba mikrofiltracias, ultrafiltraciasa da maRalforovan nanofiltracias. aqedan gamomdinare winamdebare samuSaoSi ganxiluli iqneba is baromembranuli procesebi (dabalforovani nanofiltracia da ukuosmosi), romlebic uzrunvelyofen wylis marilSemcvelobis sxvadasxva doneze Semcirebas.

nanofiltraciuli membranebi, remlebic aTvisebul iqnen wina saukunis bolos, warmatebiT axorcieleben monovalenturi ionebis gayofas. nanomasalaTa Soris nanofiltraciul membranebs ukaviaT gansakuTrebuli mdgomareoba. nanofiltraciuli procesi warmoadgens Sualedur process ultrafiltraciasa da ukuosmosi Soris. igi

saSualebas iZleva xsnars moacilos 10 nm. _ dan 100 nm. _ mde sididis nawilaki. organuli nivTierebebis molekulebis wonis mixedviT nanofiltaciuli membranebis muSa diapazonia 200 _ dan 5000 daltonamde. aseve, xdeba gaxsnili marilebis Sekaveba 25 _ 98% -iT. 20 _ 80% xdeba im marilebis Sekaveba, romlebic Seicaven erTvalentian ionebs _ natriumis an kalciumis qlorids, xolo 90 _ 98% Sekaveba xdeba im marilebis, romelnic Seicaven orvalentian ionebs, magaliTad magniumis sulfati. nanofiltraciis meSveobiT zedapiruli wylebidan SesaZlebelia ferisa da organuli naxSirbadis mocileba. aseve gaxsnili nivTierebebis raodenobisa da sixistis saerTo Semicreba. nanofiltraciuli procesi xorcieldeba 2,0 _ 8,0 atmosferuli wnevis diapazonSi.

nanofiltraciuli membrana gaxsnili marilebisaTvis ar warmoadgens srulyofil Zgides. marilgamtarobis xarisxi SesaZlebelia iyos dabali an maRali, gamomdinare iqidan Tu ra saxisaa Sesakavebeli marili da ra tipisaa nanofiltraciuli membrana. nanofiltraciul membranebs dabali gaRwevadobiT gaaCniaT TiTqmis iseTive muSa wneva, rogoric ukuosmosis membranebs. SedarebiT maRali gaRwevadobis nanofiltraciuli membranebi muSaoben ufro dabal wnevebze. nanofiltraciuli da ukuosmosuri procesis srulyofilad ganxorcieleba SesaZlebelia mxolod tangencialuri filtraciis membranul danadgarebze. procesis ganxorcieleba mizanSewonili aris wnevis impulsuri naxtomebisa da hidravlikuri dartynebis maqsimalurad SemicrebiT, radgan ar moxdes membranuli aparatis plastmasis detalebis arasasurveili deformireba (mikro bzarebis warmoqmna da a. S) da membranebis mwyobridan gamosvla (membranis denadoba, geometriuli zomebis darRveva, forebis zomebis damaxinjeba), rac Tavis mxriv SeiZleba gamoixatos procesis xarisxobri maCveneblis nawilobriv an mTlian darRvevaSi.

maRali wnevis tumbos meSveobiT sawyisi siTxe uwyvetad miewodeba nanofiltraciul sistemas. membranul sistemaSi sawyisi siTxe iyofa dabali marilSemicvelobis nakadad, romelsac gawmendili produqtis anu filtratis miiReba, xolo maRali koncentraciis mqone nakadis saxiT gamoedineba retentati. koncentratის raodenobisa da wnevis maregulirebeli saketi, aseve axdens zemoqmedebas permeatis raodenobis sidideze.

samecniero-kvleviTi da gamoyenebiTi samuSaoebis Catarebis mizania Seiqmnas da aTvisebisaTvis momzaddes membranuli teqnika da teqnologiis bazaze konkurentunariani nanosistema, romelic saSualebas mogvcems miviRoT Tanamedrove, maRali funqcionaluri Tvisbebis da teqniko-ekonomiuri maCveneblis mqone membranuli aparatura, romelic uzrunvelyofs sameli wylis demineralizacias saerTo sixistis maCveneblis Semdeg diapazonSi 1.5 – 3.5 mg-eqv/l da gavceT am uaxlesi teqnologiis praqtikuli realizaciis dasabuTebuli rekomendaciebi, rac TavisTavad inovaciuri saqmianobis anu inovaciuri procesis ganxorcielebas niSnavs.

dasaxuli amocanis SesrulebisaTvis eqsperimentaluri kvlevebi tardeboda institutis mier damuSavebul da Seqmnil laboratoriuil membranul danadgarze, romlis piloturi prototipi warmodgenili iyo 2009 wels, TbilisSi Catarebul Rvinis saerTaSoriso gamofenaze.



sur.1.

eqsperimentaluri membranuli danadgaris aRwera

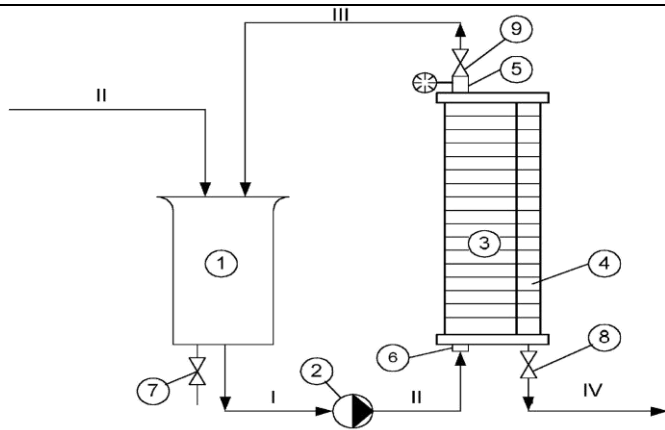
eqsperimentaluri danadgari Sedgeba (nax. 1) sawyisi avzidan 1, tumbosagan 2, membranuli aparatisagan 3 Tavisi filtratis SemkrebiT 4, ukusarqvlIT 5 da StuceriT 6. danadgars gaaCnia ventilebi 7, 8 da 9. danadgari aRWurvilia milgayvanilobebiT I, II, III da IV.

membranuli danadgari muSaobs Semdegnairad: sawyisi wyali avzidan 1 tumbos 2 saSualebiT, milgayvanilobebis I da II da Stuceri 6 gavliT miewodeba membranul aparatSi 3.

gavlis ra membranuli aparatis 3 yvela muSa sakans TanmimdevrobiT qvemodan zemoT wylis nawili gadis membranebSi da filtratis anu produqtis saxiT Semkrebis 4 da ventilis 8 gavliT milgayvanilobiT IV gamoiyvaneba membranuli aparatidan 3.

wylis is nawili, romelmac ver moaswro membranebSi gavla wylidan gamoyofil sixistis marilebTan (Ca, Mg) erTad, ukusarqvlis 5 da ventilis 9 gavliT milgayvanilobiT III recirkulirdeba da koncentratiss saxiT brundeba avzSi 1.

amrigad, wylidan gamoyofili (mebranebis mier Sekavebuli) marilebi grovdebian avzSi 1. amitom periodulad saWiroa am dagrovili koncentratiss gamotvirTva sawyisi avzidan 1 specialuri ventilis 7 saSualebiT.



ნახ. 1

მემბრანული ექსპერიმენტალური დანადგარის პრინციპული სქემა
 1-საწისი ავზი, 2-ტუმბო, 3-მემბრანული აპარატი, 4-ფილტრატის შემკრები, 5-უკუსარქველი, 6-შტუცერი, 7,8,9-ვენტილები, I, II, III, IV-მიღვაკვანილობები

wylis nawilobrivi (1.5–3.5 mg-eqv/l diapazoni) demineralizaciis procesis kvlevis meTodika

cdebi tardeba wylis nawilobrivi demineralizaciis mizniT. sasmel wyalSi saerTo mineralizaciis maCvenebeli, moqmedi standartebis mixedviT Seadgens 1000-1500 mg/l, saerTo sixiste meryeobs 7,0-10,0 mg-eqv/l diapazonSi. wylis ultrafiltraciuli damuSavebis Semdgom miRebuli SedegebiT saerTo mineralizacia Sedgens 291,064 mg/l, saerTo sixiste – 3,444 mg-eqv/l, xolo el.gamtaroba 27×10^{-3} sim/m.

eqsperimentaluri kvlevi dros gamoiyeneba Semdegi mowyobilobebi da xelsawyoebi: eqsperimentaluri membranuli danadgari, sxvadasxva tevadobis qimiuri WurWeli, wamzomi sinjis aRebis xangrZliobis gansazRvrisaTvis da el. gamtarobis mzomi xelsawyo, konduqtometri KEL-1M2.

vinaidan demineralizaciis mizania dabalmolekuluri nivTierebebis moxsna, amitom cdebi unda Catardes dabalforiani nanofiltraciuli membranebis gamoyenebiT. viRebT nanofiltraciul membranebis tips NF-70-s.

sasmeli wylis nanofiltraciit damuSaveba xdeba 3-8 atm. wnevis qveS da 250 l/sT xarjis pirobebSi.

rogorc zemoT aRiniSna, sawyisi wyali winaswar damuSavebulia ultrafiltraciis meTodiT 1,4-2,0 atm. wnevis qveS 300 l/sT xarjis pirobebSi.

Catarebuli cdebis mixedviT dadginda membranuli procesis reJimuli parametrebi, romlis drosac viRebT nawilobrivi demineralizebul wyals saerTo sixistiT 1,5 mg-eqv/l da el.gamtarobiT 9×10^{-3} sim/m.

sawyisi da gafiltruli wylebis sixiste da el. gamtarobis maCveneblebi mocemulia cxrili 1.

cxrili 1.

membranis tipi	sixiste, mg-eqv/l		el.gamtaroba, sim/m	
	sawyis wyalSi	gafiltrul wyalSi	sawyis wyalSi	gafiltrul wyalSi
ULUF-20	3.5	3,444	27×10^{-3}	23×10^{-3}

N NF-70	3.5	1.5	27×10^{-3}	9×10^{-3}
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Catarda damuSavebuli wylis filtratebis xarixobrivu analizi maTi mineralizaciis donis dadgenis mizniT, romelTa safuZvelzec dadginda membranebis is tipebi, romlebmac uzrunvelyves wylis sinjebis saerTo sixistis 1,5 – 3.5 mg-eqv/l diapazoni.

miRebuli Sedegebis mixedviT ganisazRvrebA wylis nawilobrivu demineralizaciis ganxorcielebisaTvis saWiro membranuli procesi da optimaluri membranebis tipebi.

eqsperimentaluri kvlevis safuZvelze ganisazRvra wylis demineralizaciis optimaluri membranuli procesis xvedriTi warmadoba. amisaTvis filtraciis procesSi yoveli 5 – 10 wuTis Semdeg isinjeba filtratis raodenoba.

miRebuli monacemebis safuZvelze ganisazRvrebA xvedriTi warmadobis damokidebuleba drosTan, romlis mixedviTac moxdeba sawarmoo membranuli aparatis gaTvla da membranebis regeneraciis periodis dadgena.

Catarebuli samecniero-kvleviTi samuSaos aqtualobam da inovaciurobam ganapiroba misi samrewvelo realizeba kvebis mrewvelobis iseT mniSvnelovan dargSi, rogoric aris ludis warmoeba.

Cvens mier Catarebulma saZiebo samuSaoebma dagvanaxa, rom ludis warmoebaSi wyali warmoadgens umniSvnelovanes nedleulsa da teqnologiur produqts. igi gamoiyeneba mTel rig procesebSi da misi xarji Seadgens 4-12 litrs 1 litri ludis dasamzadeblad. wylis kaTionebi da anionebi gavlenas axdenen ludis pH-ze, rac aisaxeba fermentaciul procesze misi warmoebisas. isini gavlenas axdenen duRilis mimdinareobaze da, sablood ludis gemosa da mdgradobaze. ualkoholo produqciis warmoebisagan gansxvavebiT, ludis xarSvisas aucilebelia sixistis marilebis arseboba. magram Tu kalciumis arseboba SesaZlebelia mis zRvrul mniSvnelobamde 2-4 mg-eqv/l, magniumis marilebi luds mware gemos aZleven. natriumis maRali Semcvelobac ar aris sasurveli, ramdenadac mJave-marilian gemos aZlevs. qloridebis siWarbe anelebs ludis warmoebis process, xolo sulfatebis siWarbe mware da mSral gemos aZlevs. didi mniSvneloba aqvs aseve wylis tutianobas. imisaTvis raTa uzrunvelyofil iqnas sxvadasxva adgilebsa da qveynebSi warmoebuli ludis gemovnebiTi maxasiaTeblebis maRali xarixi aucilebelia misi warmoebis ara marto identuri pirobekis Seqmna, aramed alaos, sviis da ra Tqma unda wylis Sedgenilobis identuri xarixi.

institutis mier Catarebuli samecniero-kvleviTi samuSaoebiT dainteresda Cexuri ludis saxarSi qarxnebis teqnikuri aRWurvilobis damamzadebeli kerZo organizacia S.p.s. “destila”, romelmac mogvmarTa TxovniT dagvemzadebina “destilas” xarixis (cxrili 2.), nawilobriv demineralizebuli wylis misaRebi membranuli nanoteqnologa da nanoteqnika.

cxrili 2.

“destilas” xarixis wylis qimiuri Semadgenloba

DESTILA

Doporučené chemické složení vody pro pivovarské účely Рекомендательный химический состав воды для пивоварения

Tvrdost obecná mg ekv/l		2-4
Жесткость общая мг экв/л		
Zasaditost, mg ekv/l		0,5 – 1,5
Щелочность мг экв/л		
Sušina max mg ekv/l		500
Сухой остаток мг/л не более		
pH		6 – 6,5
Kalcium, mg ekv/l	(Ca)	2 – 4
Кальций мг экв/л		
Magnezium mg ekv/l	(Mg)	Stopy
Магний мг экв/л		
Železo max mg/l	(Fe)	0,1
Железо мг/л не более		
Mangan max mg/l	(Mn)	0,1
Марганец мг/л не более		
Hliník max mg/l	(Al)	0,5
Алюминий мг/л не более		
Chloridy mg/l		100-500
Хлориды мг/л		
Sulfáty mg/l		100-150
Сульфаты мг/л		
Nitraty max mg/l		10
Нитраты мг/л не более		
Nitridy mg/l		0
Нитриты мг/л		
Zinek max mg/l	(Zn)	5
Цинк мг/л не более		
Amoniak mg/l		stopy
Аммиак мг/л		
Křemík max mg/l	(Si)	2
Кремний мг/л не более		
Měď max mg/l	(Cu)	0,5
Медь мг/л не более		
Okysličitelnost, max mg O ₂ /l		2
Окисляемость мг O ₂ /л не более		

S.p.s. “destilas” mīer mowodebuli wylis qimiuri Semadgenloba da sixiste (2,0 – 4.0 mg-equiv/l) Cvens mīer damuSavebuli wylis nawilobrivi demineralizaciis (1,5 – 3.5 mg-equiv/l) diapazonTan srul SesabamisobaSia, ramac ganapiroba membranuli aparaturis eqsploataciaSi gaSveba S.p.s. “oqros kaTxis” Cexuri ludis saxarS qarxanaSi.

membranuli teqnologiis sainJinro institutis mīer Catarebul samuSaoTa safuZvelze Cexuri ludis saxarS sawarmoSi eqsploataciaSi gaSvebuli membranuli danadgari dRemde warmatebiT funqcionirebs.

membranuli danadgaris saerTo xedi mocemulia sur. 2



sur. 2

anotacia

samecniero-kvleviT samuSaoSi gaSuqebulia sasmeli wylis nawilobrivi demineralizaciis gansaxorcieleblad ultrafiltraciuli da nanofiltraciuli baromembranuli procesebis kombinirebuli meTodis kvleva. ganxilulia nanofiltraciuli meTodis zRvruli SesaZleblobebi sasmeli wylis demineralizaciis kuTxiT. eqsperimentebi Catarebulia im tipis nanofiltraciuli membranebis gamoyenebiT, romelTa meSveobiT miRebulia saerTo sixistis 1,5-3,5mg-eqv/l maCveneбели. teqnologiuri procesis damuSavebis Teoriuli da eqsperimentaluri samuSaoebi tardeboda sainJinro institutis mier Seqmnil teqnukur da teqnologiur bazaze.

Catarebul samuSaoTa xarisxma da dasmuli sakiTxis aqtualobam ganapiroba Cexuri ludis saxarSi qarxnebis, teqnikuri aRWurvilobis damamzadebeli kerZo organizacia S.p.s. “destilas” daintereseba, romlis Txovnis safuZvelzec eqsploataciaSi gaeSva membranuli teqnologiebis sainJinro institutis mier damuSavebuli da Seqmnili ludis dasamzadebeli wylis nanofiltraciuli, membranuli aparatura.

#	samuSaos dasaxeleba	samuSaos xelmZRvaneli	samuSaos Semsruleblebi
2	ultrafiltraciuli da ukuosmosuri (erTmagi) baromembranuli procesebis kombinirebuli meTodis kvleva sasmeli wylis nawilobrivi (1,5 mg-eqv/l naklebi) demineralizaciisTvis	g. bibileiSvili	membranuli teqnologiisa da teqnikis damuSavebis ganyofileba xelmZRvaneli-e.kakabaZe

pirvel etapze ganxiluli nanofiltraciuli procesisgan gansxvavebiT ukuosmosuri, baromembranuli procesi iZleva wylis ufro Rrma demineralizaciis saSualebas, rac eleqtro gamtarobiT gamoisaxebe 25×10^{-4} _ 90×10^{-4} sim/m diapazonSi. mocemuli diapazoni Seesabameba wylis ukuosmosuri (erTmagi) meTodiT sxvadasxva xarisxiT damuSavebas.

ukuosmosi aris Txieri narevis baromembranuli gayofis procesi, naxevradgamtar membranaSi gamxsnelis

am etapze samecniero-kvleviTi samuSaoebis Catarebis mizania wylis (nanofiltraciasTan SedarebiT ufro Rrma demineralizacia) erTmagi ukuosmosis procesis kvleva, siTxis demineralizaciis diapazonis gansazRvrisaTvis el. gamtarobis maCveneblebis mixedviT. miRebuli el.gamtarobis maCveneblis qveda zRvrisaTvis piloturi membranuli aparatis damuSaveba. miRebuli Sedegebis safuZvelze Tanamedrove, maRali funqionaluri Tvisebebisa da teqniko-ekonomiuri maCveneblebis mqone membranuli aparaturis Seiqmniisa da aTvisebisaTvis uaxlesi teqnologiis praqtikuli realizaciis dasabuTebuli rekomendaciebis gacema, sameli wylis demineralizaciis saerTo sixistis maCveneblis Semdeg, savaraudo diapazonSi <1.5 mg-eqv/l.

dasaxuli amocanis SesrublebisaTvis eqsperimentaluri kvlevebi tardeboda institutis mier damuSavebul da Seqmnil laboratoriu membranul danadgarze, romlis saerTo xedi da muSaobis principi warmodgenilia nanofiltraciuli baromembranuli procesebis kombinirebuli meTodis kvlevis aRweris dros.

wylis erTmagi ukuosmosiT (<1.5 mg-eqv/l diapazoni) demineralizaciis procesis

kvlevis meTodika

cdebi tardeba ukuosmosuri, naxebradgamtari membranebis gamoyenebiT wylis nawilobrivi, sxvadasxva doneze demineralizaciis mizniT. rogorc zemoT iyo aRnoSnuli sasmel wyalSi saerTo mineralizaciis maCveneblis, moqmedi standartebis mixedviT Seadgens 1000-1500 mg/l, saerTo sixiste meryeobs 7,0-10,0 mg-eqv/l diapazonSi. wylis ultrafiltraciuli damuSavebis Semdgom miRebuli SedegebiT saerTo mineralizacia Sedgens 291,064 mg/l, saerTo sixiste – 3,444 mg-eqv/l, xolo el.gamtaroba 27×10^{-3} sim/m.

eqsperimentaluri kvlevi dros gamoyeneba Semdegi mowyobilobebi da xelsawyoebi: eqsperimentaluri membranuli danadgari, sxvadasxva tevadobis qimiuri WurWeli, wamzomi sinjis aRebis xangrZliobis gansazRvrisaTvis da el. gamtarobis mzomi xelsawyo, konduqtometri KEL-1M2.

erTmadi ukuosmosuri meTodiT demineralizaciis zRvrebis diapazonis dasadgenad mizanSewonilia cdebi Catardes sami, sxvadasxva tipis ukuosmosur membranaze. eqsperimentebisTvis SevirCieT Semdegi tipis membranebi: RO-70, RO-80 da RO-95.

sasmeli wylis ukuosmosiT damuSaveba xdeba 7-12 atm. wnevis qveS da 200 l/sT xarjis pirobebSi.

rogorc zemoT aRiniSna, sawyisi wyali winaswar damuSavebulia ultrafiltraciis meTodiT 1,4-2,0 atm. wnevis qveS 300 l/sT xarjis pirobebSi.

Catarebuli cdebis mixedviT dadginda membranuli procesis reJimuli parametrebi, romlis drosac viRebT nawilobrivi demineralizebuli wylis el.gamtarobis sam maCveneblis: 1) 78.2×10^{-4} sim/m, 2) 34.7×10^{-4} sim/m, 3) 25.3×10^{-4} sim/m.

sawyisi da gafiltruli wylebis sixiste da el. gamtarobis maCveneblebi mocemulia cxrili 1.

cxrili 1.

membranis tipi	sixiste, mg-eqv/l		el.gamtaroba, sim/m	
	sawyis wyalSi	gafiltrul wyalSi	sawyis wyalSi	gafiltrul wyalSi
ULUF-20	3.5	3.444	27×10^{-3}	23×10^{-3}
N RO-70	3.5	1.5	27×10^{-3}	78.2×10^{-4}
RO-80	3.5	<1.5	27×10^{-3}	34.7×10^{-4}
RO-95	3.5	<1.0	27×10^{-3}	25.3×10^{-4}

Catarda damuSavebuli wylis filtratebis xarixobrivi analizi maTi mineralizaciis donis dadgenis mizniT,

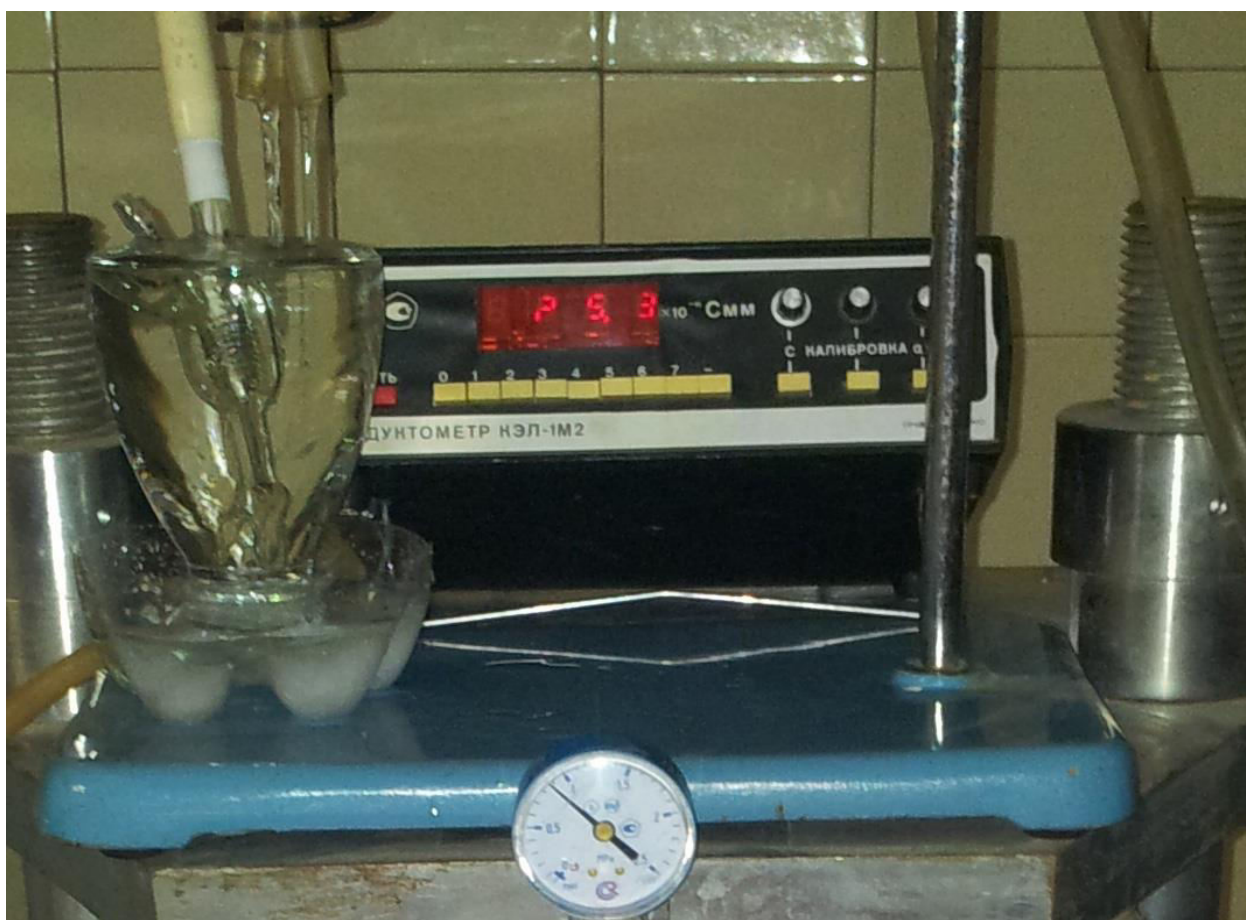
romelTa safuZvelzec dadginda wylis sinjebis saerTo sixistis maCveneblebi: 1)1.5 mg-eqv/l, 2) <1.5 mg-eqv/l, 3) <1.0 mg-eqv/l.

miRebuli Sedegebis mixedviT ganisazRvreba erTmagi ukuosmosis pirobebSi wylis nawilobrivi demineralizaciis ganxorcielebisaTvis saWiro membranuli procesi da optimaluri membranebis tipebi.

eqsperimentaluri kvlevis safuZvelze ganisazRvra wylis demineralizaciis optimaluri membranuli procesis xvedriTi warmadoba. amisaTvis filtraciis procesSi yoveli 30 wutis Semdeg isinjeba filtratis raodenoba.

miRebuli monacemebis safuZvelze ganisazRvreba xvedriTi warmadobis damokidebuleba drosTan, romlis mixedviTac moxdeba ukuosmosuri, piloturi membranuli aparatis gaTvla da membranebis regeneraciis periodis dadgena.

sur.1-ze naCvenebia ukuosmosuri, piloturi membranuli danadgaris muSaobis myisieri momenti da dafiqsirebulia permeatis el.gamtarobis maCvenebeli ($25,3 \times 10^{-4}$ sim/m), 9,0atm. wnevisa da retentatis 200l/sT raodenobis dros.



sur.1

Catarebuli samecniero-kvleviTi samuSaos Sedegebi, SesaZloa safuZvlad daedos orTqlis qvabebis gamarTul muSaobas energetikaSi da samedicino daniSnulebis deionizatorebisaTvis saTanado xarixsis (saerTo sixiste da el.gamtaroba) wylis miwodebas.

anotacia

samecniero-kvleviT samuSaoSi gaSuqebulia sasmeli wylis nawilobrivi demineralizaciis gansaxorcieblad ultrafiltraciuli da erTmagi ukuosmosuri baromembranuli procesebis kombinirebuli meTodis kvleva. ganxilulia

ukuosmosis meTodis upiratesoba membranuli filtraciis sxva procesebTan SedarebiT. gansazRvrulia wylis sxvadasxva xarisxiT demineralizaciis diapazoni. eqsperimentebi Catarebulia sxvadasxva tipis ukuosmosur naxebradgamtar membranebis gamoyenebiT sainJinro institutSi Seqmnil laboratoriu danadgarze. gansazRvrulia gafiltruli wylis saerTo sixiste, el.gamtaroba, procesis teqnologiuri parametrebi: wneva, wylis xarji, xvedriTi warmadoba. kvlevis Sedegebi mizanSewonilia gamoyenebul iqnas medicina da energetikaSi.

publikaciebi:

saqarTveloSi

statiebi

#	avtori/avtorebi	statiis saTauri, Jurnalis/krebulis dasaxeleba	Jurnaliskrebulis nomeri	gamocemis adgili, gamomcemloba	gverde bis raode noba
1	g.bibileiSvili k.domianiZe	xsnarebis baromembranuli meTodebiT damuSavebis Tanamedrove mdgomareoba. saqarTvelos qimiuri Jurnalime-13 tomi, 2013 w.	#2	q.Tbilisi, saqarTvelos qimiuri sazogadoebis Jurnal	3gv.@
2	g.bibileiSvili	Nano filtration membrane unit for water filtrationfor Czech beer production. saqarTvelos qimiuri Jurnalime-13 tomi, 2013 w.	#2	q.Tbilisi, saqarTvelos qimiuri sazogadoebis Jurnal	3gv.@
3	g.bibileiSvili l.yufaraZe e.kakabaZe	molekuluri da ionuri sistemebis gayofa-fraqcionirebis procesebis modelirebis zogierTi sakiTxebi. saqarTvelos qimiuri Jurnalime-13 tomi, 2013 w.	#2	q.Tbilisi, saqarTvelos qimiuri sazogadoebis Jurnal	3gv.
<p>naSromSi ganxilulia ionuri, molekuluri, makromolekuluri da granulometriuli zomebis mqone komponentebis Semcveli, sxvadasxva saxis xsnarebis damuSavebisatvis, baromembranuli procesebis kombinirebuli meTodebis gamoyenebis mizanSewoniloba. cxrili saxiT naCvenebia gavrclebul nivTierebaTa da membranuli gayofis procesebis Soris damokidebuleba xazobrivi zomebis mixedviT.</p> <p>moyvanilia dinamikaSi dafiqsirebuli eqsperimentis msvlelobisas sacdeli siTxis deionizaciis magaliTi da misi Sedegebi.</p> <p>samecniero-kvleviT samuSaoSi gaSuqebulia sasmeli wylis nawilobrivi demineralizaciis gansaxorcieleblad</p>					

ultrafiltraciuli da nanofiltraciuli baromembranuli procesebis kombinirebuli meTodis kvleva.

Catarebul samuSaoTa safuZvelze eqsploataciaSi gaeSva membranuli teqnologiebis sainJinro institutis mier damuSavebuli da Seqmnilo ludis dasamzadebeli wylis nanofiltraciuli, membranuli aparatura.

naSromSi ganxilulia molekulari da ionuri sistemebis gayofa- fraqcionirebis procesebis modelirebis sakiTxi, romelic moicavs procesis maTematikur formirebis, gantolebaTa sistemis amoxsnis meTodis SerCevisa da obieqtis modelTan adekvaturobis aspeqtibs.

sakiTxis Seswawlisas aRniSnulia procesis damaxasiaTebeli zogierTi parametris damatebiTi meTodebiT dazustebis mniSvneloba.

moyvanilia membranuli aparatisTvis struqturuli nakadis hidrodinamiuri da koncentraciis Tvisobrivi gantoleba.