ProductInformation

Nutrient Mixtures (Ham)

Ham's Nutrient Mixtures were originally developed to support clonal growth of several clones of Chinese hamster ovary (CHO) cells, as well as clones of HeLa and mouse L-cells. Both mixtures were formulated for use with or without serum supplementation, depending on the cell type being cultured. Ham's F-10 has been shown to support the growth of human diploid cells, white blood cells for chromosomal analysis, primary explants of rat, rabbit and chicken tissues. Ham's F-12 has been used for the growth of primary rat hepatocytes and rat prostate epithelial cells. A clonal toxicity assay using CHO cells has also been reported with Ham's F-12 as the medium of choice. Ham's F-12 is also available with 25mM HEPES buffer that provides more effective buffering in the optimum pH range of 7.2-7.4.

	N 6635 (F-10)	**N 1387 (F-10)**	**N 6760 (F-12)**	**N 4388 (F-12)**
COMPONENT	g/L	g/L	g/L	g/L
INORGANIC SALTS				
$CaCl_2 \cdot 2H_2O$	0.0441	0.0441	0.0441	0.0441
$CuSO_4 \cdot 5H_2O$	0.0000025	0.0000025	0.0000025	0.0000025
$FeSO_4 \cdot 7H_2O$	0.000834	0.000834	0.000834	0.000834
$MgCl \cdot 6H_2O$	—	—	0.123	0.123
$MgSO_4$	0.07464	0.07464	—	—
KCl	0.285	0.285	0.224	0.224
KH_2PO_4	0.083	0.083	—	—
NaCl	7.4	6.8	7.599	7.1
Na_2HPO_4	0.1537	0.1537	0.14204	0.14204
$ZnSO_4 \cdot 7H_2O$	0.0000288	0.0000288	0.000863	0.000863
AMINO ACIDS				
L-Alanine	0.009	0.009	0.009	0.009
L-Arginine•HCl	0.211	0.211	0.211	0.211
L-Asparagine•H_2O	0.01501	0.01501	0.01501	0.01501
L-Aspartic Acid	0.0133	0.0133	0.0133	0.0133
L-Cysteine•HCl•H_2O	0.035	0.035	0.035	0.035
L-Glutamic Acid	0.0147	0.0147	0.0147	0.0147
L-Glutamine	0.146	0.146	0.146	0.146
Glycine	0.00751	0.00751	0.00751	0.00751
L-Histidine•HCl•H_2O	0.021	0.021	0.02096	0.02096
L-Isoleucine	0.0026	0.0026	0.00394	0.00394
L-Leucine	0.0131	0.0131	0.0131	0.0131
L-Lysine•HCl	0.0293	0.0293	0.0365	0.0365
L-Methionine	0.00448	0.00448	0.00448	0.00448
L-Phenylalanine	0.00496	0.00496	0.00496	0.00496
L-Proline	0.0115	0.0115	0.0345	0.0345
L-Serine	0.0105	0.0105	0.0105	0.0105
L-Threonine	0.00357	0.00357	0.0119	0.0119
L-Tryptophan	0.0006	0.0006	0.00204	0.00204
L-Tyrosine 2Na•$2H_2O$	0.00261	0.00261	0.00778	0.00778
L-Valine	0.0035	0.0035	0.0117	0.0117
VITAMINS				
D-Biotin	0.000024	0.000024	0.0000073	0.0000073
Choline Chloride	0.000698	0.000698	0.01396	0.01396
Folic Acid	0.00132	0.00132	0.00132	0.00132
myo-Inositol	0.000541	0.000541	0.018	0.018
Niacinamide	0.000615	0.000615	0.000037	0.000037
D-Pantothenic Acid •½Ca	0.000715	0.000715	0.00048	0.00048
Pyridoxine•HCl	0.000206	0.000206	0.000062	0.000062
Riboflavin	0.000376	0.000376	0.000038	0.000038
Thiamine•HCl	0.001	0.001	0.00034	0.00034
Vitamin B-12	0.00136	0.00136	0.00136	0.00136

Formulas continued next page

Nutrient Mixtures (Ham) continued

COMPONENT	**N 6635 (F-10)** g/L	**N 1387 (F-10)** g/L	**N 6760 (F-12)** g/L	**N 4388 (F-12)** g/L
OTHER				
D-Glucose	1.1	1.1	1.802	1.802
HEPES	—	5.958	—	5.958
Hypoxanthine	0.00408	0.00408	0.00408	0.00408
Linoleic Acid	—	—	0.000084	0.000084
Phenol Red•Na	0.0013	0.0013	0.0013	0.0013
Putrescine•HCl	—	—	0.000161	0.000161
Pyruvic Acid•Na	0.11	0.11	0.11	0.11
Thioctic Acid	0.00021	0.00021	0.00021	0.00021
Thymidine	0.00073	0.00073	0.00073	0.00073
ADD				
Sodium Bicarbonate	1.2	1.2	1.176	1.176
Grams of powder required to prepare 1 L	9.8	15.2	10.7	16.2

Formulas continued next page

Nutrient Mixtures (Ham) continued

COMPONENT	N 6013 (F-10) [1X] g/L	N 2147 (F-10) [1X] g/L	N 4888 (F-12) [1X] g/L	N 8641 (F-12) [1X] g/L
INORGANIC SALTS				
$CaCl_2 \cdot 2H_2O$	0.0441	0.0441	0.0441	0.0441
$CuSO_4 \cdot 5H_2O$	0.0000025	0.0000025	0.0000025	0.0000025
$FeSO_4 \cdot 7H_2O$	0.000834	0.000834	0.000834	0.000834
$MgCl \cdot 6H_2O$	—	—	0.123	0.123
$MgSO_4$	0.07464	0.07464	—	—
KCl	0.285	0.285	0.224	0.224
KH_2PO_4	0.083	0.083	—	—
$NaHCO_3$	1.2	—	1.176	1.176
NaCl	7.4	7.4	7.599	7.1
Na_2HPO_4	0.1537	0.1537	0.14204	0.14204
$ZnSO_4 \cdot 7H_2O$	0.0000288	0.0000288	0.000863	0.000863
AMINO ACIDS				
L-Alanine	0.009	0.009	0.009	0.009
L-Arginine•HCl	0.211	0.211	0.211	0.211
L-Asparagine•H_2O	0.01501	0.01501	0.01501	0.01501
L-Aspartic Acid	0.0133	0.0133	0.0133	0.0133
L-Cysteine•HCl•H_2O	0.035	0.035	0.035	0.035
L-Glutamic Acid	0.0147	0.0147	0.0147	0.0147
Glycine	0.00751	0.00751	0.00751	0.00751
L-Histidine•3HCl•H_2O	0.021	0.021	0.02096	0.02096
L-Isoleucine	0.0026	0.0026	0.00394	0.00394
L-Leucine	0.0131	0.0131	0.0131	0.0131
L-Lysine•HCl	0.0293	0.093	0.0365	0.0365
L-Methionine	0.00448	0.00448	0.00448	0.00448
L-Phenylalanine	0.00496	0.00496	0.00496	0.00496
L-Proline	0.0115	0.0115	0.0345	0.0345
L-Serine	0.0105	0.0105	0.0105	0.0105
L-Threonine	0.00357	0.00357	0.0119	0.0119
L-Tryptophan	0.0006	0.0006	0.00204	0.00204
L-Tyrosine 2Na•$2H_2O$	0.00261	0.00261	0.00778	0.00778
L-Valine	0.0035	0.0035	0.0117	0.0117
VITAMINS				
D-Biotin	0.000024	0.000024	0.0000073	0.0000073
Choline Chloride	0.000698	0.000698	0.01396	0.01396
Folic Acid	0.00132	0.00132	0.00132	0.00132
myo-Inositol	0.000541	0.000541	0.018	0.018
Niacinamide	0.000615	0.000615	0.000037	0.000037
D-Pantothenic Acid •½Ca	0.000715	0.000715	0.00048	0.000238
Pyridoxine•HCl	0.000206	0.000206	0.000062	0.000062
Riboflavin	0.000376	0.000376	0.000038	0.000038
Thiamine•HCl	0.001	0.001	0.00034	0.00034
Vitamin B-12	0.00136	0.00136	0.00136	0.00136
OTHER				
D-Glucose	1.1	1.1	1.802	1.802
HEPES	—	4.77	—	5.958
Hypoxanthine	0.00408	0.00408	0.00408	0.00408
Linoleic Acid	—	—	0.000084	0.000084
Phenol Red (sodium)	0.0013	0.0013	0.0013	0.0013
Putrescine•HCl	—	—	0.000161	0.000161
Pyruvic Acid (sodium)	0.11	0.11	0.11	0.11
Thioctic Acid	0.00021	0.00021	0.00021	0.00021
Thymidine	0.00073	0.00073	0.00073	0.00073

Formulas continued next page

Nutrient Mixtures (Ham) continued

COMPONENT	**N 6013 (F-10) [1X]** g/L	**N 2147 (F-10) [1X]** g/L	**N 4888 (F-12) [1X]** g/L	**N 8641 (F-12) [1X]** g/L
ADD				
L-Glutamine	0.146	0.146	0.146	0.146
Sodium Bicarbonate	—	—	—	—

REFERENCES

1. Ham, R.G., (1963). An Improved Nutrient Solution for Diploid Chinese Hamster and Human Cell Lines. Exp. Cell Res. 29, 515-526.
2. Ham, R.G., (1965). Clonal Growth of Mammalian Cells in a Chemically Defined, Synthetic Medium. Proc. Nat. Acad. Sci. 53, 288-293.