
AbSciCon
2019

1
00:00:00,790 --> 00:00:07,320
[Music]

2
00:00:12,600 --> 00:00:09,350
[Applause]

3
00:00:14,280 --> 00:00:12,610
hello I'm Jessica Kramer part of the

4
00:00:16,740 --> 00:00:14,290
chemical analysis and life detection

5
00:00:18,930 --> 00:00:16,750
group at JPL our group is interested in

6
00:00:21,480 --> 00:00:18,940
building instruments and methodologies

7
00:00:23,150 --> 00:00:21,490
to search for chemical signs of life on

8
00:00:25,950 --> 00:00:23,160
other planets

9
00:00:27,180 --> 00:00:25,960
one particularly interesting target and

10
00:00:30,510 --> 00:00:27,190
the reason we're all here in this room

11
00:00:33,390 --> 00:00:30,520
is Enceladus the chairs of this session

12
00:00:35,100 --> 00:00:33,400
did a great job in motivating all the

13
00:00:37,260 --> 00:00:35,110

different lines of evidence the Cassini

14
00:00:39,830 --> 00:00:37,270
found that showed that there could be an

15
00:00:42,720 --> 00:00:39,840
active motion rock interface in

16
00:00:45,569 --> 00:00:42,730
Enceladus is ocean this is a really

17
00:00:47,040 --> 00:00:45,579
exciting discovery and opens up a lot of

18
00:00:48,840 --> 00:00:47,050
questions as to the habitability of

19
00:00:51,780 --> 00:00:48,850
Enceladus is ocean and the chemical

20
00:00:55,440 --> 00:00:51,790
composition and really is a nice

21
00:00:57,810 --> 00:00:55,450
motivator for sending another follow-on

22
00:01:00,750 --> 00:00:57,820
mission to pick up where Cassini left

23
00:01:03,389 --> 00:01:00,760
off and really get more specific

24
00:01:06,749 --> 00:01:03,399
chemical analysis done on the compounds

25
00:01:08,340 --> 00:01:06,759
in the plant water one particular target

26
00:01:10,529 --> 00:01:08,350
that we're interested in going to look

27
00:01:11,700 --> 00:01:10,539
for our amino acids amino acids can tell

28
00:01:13,140 --> 00:01:11,710
you a lot about what's happening in the

29
00:01:15,410 --> 00:01:13,150
planet because they can be generated

30
00:01:17,490 --> 00:01:15,420
abiotic ly through geochemical processes

31
00:01:21,210 --> 00:01:17,500
they can also be an indication of

32
00:01:26,399 --> 00:01:21,220
prebiotic chemistry and then also maybe

33
00:01:28,440 --> 00:01:26,409
point to the presence of extant life but

34
00:01:30,420 --> 00:01:28,450
it's not exactly enough to just go and

35
00:01:32,250 --> 00:01:30,430
find amino acids because they can be

36
00:01:35,280 --> 00:01:32,260
made a biotic aliy and in fact there is

37
00:01:36,870 --> 00:01:35,290
a lot of overlap between the amino acids

38
00:01:38,490 --> 00:01:36,880

that are formed biotic lees and those

39
00:01:40,969 --> 00:01:38,500
are formed abiotic ly and those that are

40
00:01:44,190 --> 00:01:40,979
used in biotic systems not surprisingly

41
00:01:46,260 --> 00:01:44,200
so instead it'd be good to go and bring

42
00:01:48,870 --> 00:01:46,270
a technique that can survey all the

43
00:01:50,310 --> 00:01:48,880
different amino acids in the sample and

44
00:01:51,719 --> 00:01:50,320
once you have that you have that

45
00:01:53,340 --> 00:01:51,729
information you can start to look for

46
00:01:56,310 --> 00:01:53,350
patterns that can indicate the presence

47
00:01:57,990 --> 00:01:56,320
of abiotic or biotic chemistry one of

48
00:02:00,749 --> 00:01:58,000
those patterns is what type of amino

49
00:02:02,789 --> 00:02:00,759
acids are there in particular histidine

50
00:02:05,399 --> 00:02:02,799
is only made through biotic chemistry so

51
00:02:06,990 --> 00:02:05,409
if you were to find that somewhere and

52
00:02:08,609 --> 00:02:07,000
you know we didn't bring it with us

53
00:02:10,289 --> 00:02:08,619
then it would be a good indication that

54
00:02:14,190 --> 00:02:10,299
something other than a biotic chemistry

55
00:02:15,930 --> 00:02:14,200
was taking place the next pattern you

56
00:02:16,260 --> 00:02:15,940
can look at is the relative abundance of

57
00:02:17,970 --> 00:02:16,270
the

58
00:02:20,220 --> 00:02:17,980
you know since you find to glycine

59
00:02:22,140 --> 00:02:20,230
glycine is the smallest and easiest to

60
00:02:25,050 --> 00:02:22,150
synthesize amino acid so a body

61
00:02:28,460 --> 00:02:25,060
chemistry makes a lot of it with respect

62
00:02:32,790 --> 00:02:28,470
to the larger more complex amino acids

63
00:02:35,790 --> 00:02:32,800

but life needs complexity so relative to

64
00:02:37,110 --> 00:02:35,800
glycine life uses more of those complex

65
00:02:39,410 --> 00:02:37,120
amino acids in suits use a higher

66
00:02:43,530 --> 00:02:39,420
abundance of those in biotic samples and

67
00:02:46,020 --> 00:02:43,540
then finally chirality in abiotic

68
00:02:47,940 --> 00:02:46,030
systems the left and right-handed

69
00:02:50,820 --> 00:02:47,950
version of the amino acids are generally

70
00:02:52,200 --> 00:02:50,830
created in a 50/50 mixture so if you

71
00:02:54,000 --> 00:02:52,210
were to see any sort of enantiomeric

72
00:02:55,680 --> 00:02:54,010
excess or homo chirality that would be a

73
00:02:59,610 --> 00:02:55,690
really good indication that it's not

74
00:03:01,470 --> 00:02:59,620
just a biotic chemistry so in order to

75
00:03:03,090 --> 00:03:01,480
go and search for those signs you need a

76
00:03:04,890 --> 00:03:03,100
technique that can take a sample that

77
00:03:06,300 --> 00:03:04,900
has a mixture of all those amino acids

78
00:03:08,370 --> 00:03:06,310
separate them out so that you can

79
00:03:11,670 --> 00:03:08,380
individually identify and quantify them

80
00:03:13,860 --> 00:03:11,680
and then technique that we think is the

81
00:03:16,170 --> 00:03:13,870
best is capillary electrophoresis

82
00:03:19,020 --> 00:03:16,180
it's a voltage driven separation and

83
00:03:21,120 --> 00:03:19,030
it's all liquid based so which is really

84
00:03:25,140 --> 00:03:21,130
good when you're going to go study water

85
00:03:26,850 --> 00:03:25,150
or ice it also has very low limits of

86
00:03:28,500 --> 00:03:26,860
detection down to nano molar or parts

87
00:03:31,380 --> 00:03:28,510
per trillion when coupled with laser

88
00:03:34,040 --> 00:03:31,390

induced fluorescence detection and it's

89
00:03:36,930 --> 00:03:34,050
miniaturize a bowl so this is the big

90
00:03:38,100 --> 00:03:36,940
this is the big system the commercial

91
00:03:40,350 --> 00:03:38,110
system it's about the size of a

92
00:03:42,990 --> 00:03:40,360
dishwasher and this is one of our

93
00:03:44,850 --> 00:03:43,000
portable systems the chemical laptop

94
00:03:45,750 --> 00:03:44,860
that is about the size of a shoebox so

95
00:03:47,220 --> 00:03:45,760
if you're interested in learning about

96
00:03:49,620 --> 00:03:47,230
how we're shrinking that technology and

97
00:03:55,980 --> 00:03:49,630
making it more portable go to Fernandez

98
00:03:59,070 --> 00:03:55,990
talk tomorrow so see e works by filling

99
00:04:01,560 --> 00:03:59,080
a small bore capillary about 50 micron

100
00:04:04,050 --> 00:04:01,570
in our diameter with a conductive

101
00:04:07,170 --> 00:04:04,060
solution you can then inject your liquid

102
00:04:11,490 --> 00:04:07,180
sample directly onto the capillary and

103
00:04:13,320 --> 00:04:11,500
when you apply a voltage everything in

104
00:04:15,960 --> 00:04:13,330
that plug starts to separate based on

105
00:04:17,280 --> 00:04:15,970
its size to charge ratio so you start to

106
00:04:21,570 --> 00:04:17,290
get a separation of all the different

107
00:04:23,110 --> 00:04:21,580
compounds in solution as those separate

108
00:04:24,790 --> 00:04:23,120
they move down the capillary

109
00:04:28,060 --> 00:04:24,800
they move past the detector in our case

110
00:04:29,680 --> 00:04:28,070
a laser and so you can collect a signal

111
00:04:31,420 --> 00:04:29,690
versus time plot we call an

112
00:04:33,070 --> 00:04:31,430
electropherogram that can be used for

113
00:04:36,400 --> 00:04:33,080

identification and quantification of the

114
00:04:37,990 --> 00:04:36,410
different species in solution so this is

115
00:04:41,500 --> 00:04:38,000
our electropherogram from a method that

116
00:04:43,390 --> 00:04:41,510
we made this method targets the 13 most

117
00:04:45,610 --> 00:04:43,400
abundant amino acids found in both

118
00:04:47,650 --> 00:04:45,620
abiotic and biotic samples there's a lot

119
00:04:49,420 --> 00:04:47,660
of overlap there and so with a with

120
00:04:50,710 --> 00:04:49,430
these 13 amino acids you can look for

121
00:04:52,780 --> 00:04:50,720
those bio signatures I talked about

122
00:04:55,330 --> 00:04:52,790
previously so you can see we have 13

123
00:05:01,719 --> 00:04:55,340
minutes and but we also are able to hang

124
00:05:03,189 --> 00:05:01,729
it on bed at that separate the left and

125
00:05:05,020 --> 00:05:03,199
right handed versions of the amino acids

126
00:05:08,040 --> 00:05:05,030
for five different amino acids so we can

127
00:05:10,210 --> 00:05:08,050
look for that chiral signature as well

128
00:05:12,070 --> 00:05:10,220
so back when I published the method in

129
00:05:14,350 --> 00:05:12,080
2017 our limits of detection were

130
00:05:16,390 --> 00:05:14,360
between 5 and 100 animal it's pretty

131
00:05:19,060 --> 00:05:16,400
good but we've been able to get them

132
00:05:20,680 --> 00:05:19,070
down even lower to between 1 and 25 and

133
00:05:22,659 --> 00:05:20,690
animal or depending on the amino acid

134
00:05:25,150 --> 00:05:22,669
and this is really great because it puts

135
00:05:27,520 --> 00:05:25,160
us in the range of what we see for Earth

136
00:05:29,740 --> 00:05:27,530
analogue like sub glacial lake

137
00:05:31,089 --> 00:05:29,750
environments for free amino acids so

138
00:05:34,469 --> 00:05:31,099

we're in a good place to be able to

139
00:05:36,580 --> 00:05:34,479
detect free amino acids in ocean water

140
00:05:39,580 --> 00:05:36,590
another great thing about this technique

141
00:05:41,409 --> 00:05:39,590
is it makes it really easy for end and

142
00:05:43,060 --> 00:05:41,419
analysis of liquid samples if you have a

143
00:05:45,430 --> 00:05:43,070
liquid sample all you need to do is mix

144
00:05:47,980 --> 00:05:45,440
it with some reagents to fix the pH add

145
00:05:49,960 --> 00:05:47,990
your fluorescent tag and then analyze

146
00:05:51,909 --> 00:05:49,970
that directly because we get those low

147
00:05:53,500 --> 00:05:51,919
limits of detection and because we're

148
00:05:57,339 --> 00:05:53,510
doing separation you don't need to do

149
00:06:00,129 --> 00:05:57,349
any additional pre concentration or

150
00:06:01,779 --> 00:06:00,139
desalting in fact we're able to look at

151
00:06:04,870 --> 00:06:01,789
a variety of different samples here are

152
00:06:08,820 --> 00:06:04,880
the Mono Lake water and Atacama soil

153
00:06:10,839 --> 00:06:08,830
extract and we can see very low

154
00:06:12,430 --> 00:06:10,849
concentrations of amino acids in these

155
00:06:16,390 --> 00:06:12,440
samples even though there's a variety of

156
00:06:18,960 --> 00:06:16,400
different salts and other things in the

157
00:06:21,189 --> 00:06:18,970
matrix

158
00:06:24,060 --> 00:06:21,199
so because of the capabilities of this

159
00:06:26,650 --> 00:06:24,070
method it was selected as part of the

160
00:06:28,480 --> 00:06:26,660
analysis suite on a new frontiers

161
00:06:30,189 --> 00:06:28,490
proposal called Elsa this is the

162
00:06:33,010 --> 00:06:30,199
Enceladus life signatures and

163
00:06:36,060 --> 00:06:33,020

habitability mission and it's a multi

164
00:06:38,590 --> 00:06:36,070
Center collaboration

165
00:06:40,480 --> 00:06:38,600
it's a flyby mission so it would fly

166
00:06:42,730 --> 00:06:40,490
through the plumes collect sample that

167
00:06:45,670 --> 00:06:42,740
sample would be transferred to a sample

168
00:06:47,469 --> 00:06:45,680
handling system and I think Spice from

169
00:06:49,930 --> 00:06:47,479
Ames is going to talk about that next in

170
00:06:51,850 --> 00:06:49,940
this session that sample handling system

171
00:06:53,260 --> 00:06:51,860
also includes the reagent storage needed

172
00:06:55,150 --> 00:06:53,270
to be able to run the capillary

173
00:06:59,499 --> 00:06:55,160
electrophoresis test and analyze for

174
00:07:01,810 --> 00:06:59,509
those chiral amino acids and else I

175
00:07:03,219 --> 00:07:01,820
didn't get selected this time but I

176
00:07:04,779 --> 00:07:03,229
think there will be a second proposal

177
00:07:07,960 --> 00:07:04,789
because I think it's a really important

178
00:07:11,050 --> 00:07:07,970
mission and so in order to get ready for

179
00:07:13,900 --> 00:07:11,060
the next proposal we will be we've been

180
00:07:15,430 --> 00:07:13,910
demonstrating when the stability of the

181
00:07:17,499 --> 00:07:15,440
hardware and the chemicals under

182
00:07:19,540 --> 00:07:17,509
spaceflight conditions in order to

183
00:07:22,600 --> 00:07:19,550
increase the TRL or technology readiness

184
00:07:23,920 --> 00:07:22,610
level of this technique I've been

185
00:07:25,540 --> 00:07:23,930
focusing more on the chemical side of

186
00:07:28,870 --> 00:07:25,550
things but if you're interested in

187
00:07:30,850 --> 00:07:28,880
hardware go see Nathan o Bernie's poster

188
00:07:33,339 --> 00:07:30,860

tonight he's going to talk about making

189
00:07:37,990 --> 00:07:33,349
radiation tolerant hardware specifically

190
00:07:39,430 --> 00:07:38,000
for the detection side of things the

191
00:07:40,180 --> 00:07:39,440
chemical stability is really important

192
00:07:41,830 --> 00:07:40,190
too and it's something that people

193
00:07:44,260 --> 00:07:41,840
always have questions about because

194
00:07:46,180 --> 00:07:44,270
we're bringing these like complex mostly

195
00:07:47,850 --> 00:07:46,190
organic molecules along with us and

196
00:07:51,279 --> 00:07:47,860
they're worried about them falling apart

197
00:07:52,779 --> 00:07:51,289
so the important chemicals for this test

198
00:07:55,149 --> 00:07:52,789
or the fluorescent dye this is how we

199
00:07:56,860 --> 00:07:55,159
label our amino acids and create a

200
00:08:00,180 --> 00:07:56,870
fluorescent compound then that's what

201
00:08:02,379 --> 00:08:00,190
the separation is designed to detect and

202
00:08:04,089 --> 00:08:02,389
then in order to get that really nice

203
00:08:05,830 --> 00:08:04,099
chiral resolution the resolution of all

204
00:08:06,969 --> 00:08:05,840
those amino acids at once we do need a

205
00:08:08,589 --> 00:08:06,979
kind of complicated background

206
00:08:10,839 --> 00:08:08,599
electrolyte that's the conductive

207
00:08:13,839 --> 00:08:10,849
solution that fills the capillary it's a

208
00:08:15,879 --> 00:08:13,849
mixture of three powdered reagents and

209
00:08:18,249 --> 00:08:15,889
it's mixed with an aqueous solution of

210
00:08:19,930 --> 00:08:18,259
six percent of co2 nitrile so all that

211
00:08:24,040 --> 00:08:19,940
needs to fly in order to be able to

212
00:08:25,830 --> 00:08:24,050
perform this assay so radiation is the

213
00:08:28,209 --> 00:08:25,840

big problem

214
00:08:29,800 --> 00:08:28,219
traditionally organic chemistry isn't

215
00:08:31,900 --> 00:08:29,810
great under radiation

216
00:08:33,969 --> 00:08:31,910
so we were pretty worried about this and

217
00:08:36,490 --> 00:08:33,979
to choose the worst case scenario we

218
00:08:37,899 --> 00:08:36,500
chose Europa this is far worse than

219
00:08:39,520 --> 00:08:37,909
anything we'd see in intelligence but

220
00:08:41,649 --> 00:08:39,530
still if we can do it under these

221
00:08:44,770 --> 00:08:41,659
conditions then we can do it anywhere so

222
00:08:46,570 --> 00:08:44,780
we chose the number from the Europa

223
00:08:49,870 --> 00:08:46,580
Lander science definition team report of

224
00:08:52,090 --> 00:08:49,880
300 killer ad the first thing we tested

225
00:08:54,370 --> 00:08:52,100
was our die so we exposed the die to 300

226
00:08:56,190 --> 00:08:54,380
killer ad and we were actually kind of

227
00:08:58,900 --> 00:08:56,200
shocked that it was fine

228
00:09:00,820 --> 00:08:58,910
not only did it retain its flora for so

229
00:09:03,610 --> 00:09:00,830
it allowed us to be able to detect it at

230
00:09:07,990 --> 00:09:03,620
the same concentrations as non

231
00:09:10,510 --> 00:09:08,000
irradiated die but it retained they

232
00:09:12,610 --> 00:09:10,520
retained this leaving group so this is a

233
00:09:14,829 --> 00:09:12,620
pretty labile chemical because it's

234
00:09:18,550 --> 00:09:14,839
needed to react with the amino acids but

235
00:09:21,100 --> 00:09:18,560
it was able to retain the labeling

236
00:09:22,870 --> 00:09:21,110
efficiency and then even better than

237
00:09:24,910 --> 00:09:22,880
that there were no additional Peaks

238
00:09:26,410 --> 00:09:24,920

formed so this is a fluorescent molecule

239
00:09:27,820 --> 00:09:26,420
so when you start to radiate it and it

240
00:09:29,710 --> 00:09:27,830
starts to degrade it can turn into other

241
00:09:31,360 --> 00:09:29,720
fluorescent molecules that can interfere

242
00:09:35,500 --> 00:09:31,370
with our separation and we didn't see

243
00:09:37,120 --> 00:09:35,510
that so this was really great we also

244
00:09:38,680 --> 00:09:37,130
irradiated the background electrolyte

245
00:09:40,329 --> 00:09:38,690
and we found that as long as we keep the

246
00:09:42,670 --> 00:09:40,339
powdered reagents separate from the

247
00:09:44,130 --> 00:09:42,680
liquid reagents during the irradiation

248
00:09:46,240 --> 00:09:44,140
and then mix them for analysis

249
00:09:48,400 --> 00:09:46,250
everything is fine we don't see any

250
00:09:49,780 --> 00:09:48,410
effects in migration time drift or

251
00:09:52,780 --> 00:09:49,790
difference in resolution between our

252
00:09:54,460 --> 00:09:52,790
Peaks and this just means that we have

253
00:09:55,510 --> 00:09:54,470
to have a sample handling system that

254
00:09:58,380 --> 00:09:55,520
can keep the liquid and the solid

255
00:10:01,710 --> 00:09:58,390
separate into how we're ready to use it

256
00:10:04,420 --> 00:10:01,720
and then the next thing we did

257
00:10:05,590 --> 00:10:04,430
especially for the dye we looked at the

258
00:10:07,750 --> 00:10:05,600
long-term storage at elevated

259
00:10:09,190 --> 00:10:07,760
temperatures so the diet is fairly

260
00:10:10,780 --> 00:10:09,200
sensitive to increases in temperature

261
00:10:12,910 --> 00:10:10,790
because the main degradation pathways

262
00:10:16,180 --> 00:10:12,920
hydrolysis the hotter it gets the faster

263
00:10:18,220 --> 00:10:16,190

that's gonna happen and the manufacturer

264
00:10:21,760 --> 00:10:18,230
recommends that you store it at negative

265
00:10:26,200 --> 00:10:21,770
5 C for one year and we that's too short

266
00:10:27,340 --> 00:10:26,210
for us so we needed to make sure that it

267
00:10:29,050 --> 00:10:27,350
was going to be okay at higher

268
00:10:32,079 --> 00:10:29,060
temperatures for longer so we stored it

269
00:10:34,540 --> 00:10:32,089
for one month six months one year and

270
00:10:37,840 --> 00:10:34,550
two years a variety of different

271
00:10:42,400 --> 00:10:37,850
temperatures so we chose 4 C 25

272
00:10:44,350 --> 00:10:42,410
see and 60c you can see that at the

273
00:10:47,980 --> 00:10:44,360
elevated temperatures and longer storage

274
00:10:49,600 --> 00:10:47,990
times do start to get this increase in

275
00:10:51,220 --> 00:10:49,610
background so that's the degradation of

276
00:10:53,980 --> 00:10:51,230
the die increasing the background

277
00:10:56,439 --> 00:10:53,990
however even at the worst case with 6ec

278
00:10:58,559 --> 00:10:56,449
for two years we're still able to detect

279
00:11:00,879 --> 00:10:58,569
a majority of our amino acids including

280
00:11:02,590 --> 00:11:00,889
glycine and histidine which were too

281
00:11:07,780 --> 00:11:02,600
poor important ones for those bio

282
00:11:09,879 --> 00:11:07,790
signatures that we talked about so C is

283
00:11:11,670 --> 00:11:09,889
a great technique it can provide Carle

284
00:11:13,870 --> 00:11:11,680
resolution very low limits of detection

285
00:11:15,460 --> 00:11:13,880
the chemicals needed to perform this

286
00:11:17,920 --> 00:11:15,470
assay are stable up to three hundred

287
00:11:21,430 --> 00:11:17,930
killer AD which makes them viable to fly

288
00:11:23,199 --> 00:11:21,440

just about anywhere we would will need a

289
00:11:25,420 --> 00:11:23,209
thermal control in the vault to keep the

290
00:11:27,699 --> 00:11:25,430
dye at a lower temperature so it doesn't

291
00:11:31,319 --> 00:11:27,709
start to degrade but these are the first

292
00:11:36,030 --> 00:11:31,329
steps in making this technique more

293
00:11:38,379 --> 00:11:36,040
viable for future trip to mental abyss

294
00:11:40,449 --> 00:11:38,389
so I want to thank the funding and then

295
00:11:42,220 --> 00:11:40,459
also my group is here in force so if

296
00:11:44,319 --> 00:11:42,230
you're interested in this stuff please

297
00:11:46,750 --> 00:11:44,329
and go and look at their posters and go

298
00:11:49,520 --> 00:11:46,760
watch their talks thanks

299
00:11:50,390 --> 00:11:49,530
[Applause]

300
00:11:56,500 --> 00:11:50,400
[Music]

301
00:12:05,390 --> 00:12:02,540
yeah yeah

302
00:12:07,640 --> 00:12:05,400
Richard Malthus chemistry and the space

303
00:12:10,100 --> 00:12:07,650
sciences lab at UC Berkeley

304
00:12:11,810 --> 00:12:10,110
the fly-through profile is very

305
00:12:14,060 --> 00:12:11,820
interesting but of course one of the big

306
00:12:15,650 --> 00:12:14,070
challenges that we worry about and I

307
00:12:18,200 --> 00:12:15,660
suspect you worry about is how in the

308
00:12:20,300 --> 00:12:18,210
world do you capture the molecules in

309
00:12:23,000 --> 00:12:20,310
the plume and what velocity do you

310
00:12:25,430 --> 00:12:23,010
transit through the plume okay so what

311
00:12:27,980 --> 00:12:25,440
what did you propose to do and what are

312
00:12:29,930 --> 00:12:27,990
the issues and solutions to that issue

313
00:12:33,260 --> 00:12:29,940

so I can't actually talk about that

314
00:12:37,040 --> 00:12:33,270
because that's proposal specific but we

315
00:12:39,980 --> 00:12:37,050
did propose something and if if amino

316
00:12:45,740 --> 00:12:39,990
acids are there we will detect them okay

317
00:12:48,560 --> 00:12:45,750
that's that's all just a quick question

318
00:12:51,440 --> 00:12:48,570
how much liquid sample would you need to

319
00:12:52,670 --> 00:12:51,450
do to do your analysis um so the

320
00:12:54,620 --> 00:12:52,680
injection plug for capillary

321
00:12:56,570 --> 00:12:54,630
electrophoresis about four nanoliters

322
00:12:59,750 --> 00:12:56,580
so we only need a couple of microliters

323
00:13:05,420 --> 00:12:59,760
of sample in order to couple of

324
00:13:07,820 --> 00:13:05,430
microliters okay thanks yep hi I wanted

325
00:13:10,040 --> 00:13:07,830
to know if you test this dye against

326
00:13:12,260 --> 00:13:10,050
other nitrogen in your compost like

327
00:13:14,330 --> 00:13:12,270
amines and if it's stable like for

328
00:13:16,580 --> 00:13:14,340
example with alcohols and some other

329
00:13:17,510 --> 00:13:16,590
nucleophiles to be sure to react with

330
00:13:20,150 --> 00:13:17,520
your other nucleophiles

331
00:13:22,880 --> 00:13:20,160
so this is an amine specific dye I think

332
00:13:25,760 --> 00:13:22,890
it's I don't think there's any cross

333
00:13:27,230 --> 00:13:25,770
reactivity with like other nucleophiles

334
00:13:29,420 --> 00:13:27,240
I'm pretty sure but I mean a couple

335
00:13:32,300 --> 00:13:29,430
amines in the mixture we let me know ask

336
00:13:34,160 --> 00:13:32,310
it yeah I'm five you test that yeah and

337
00:13:35,720 --> 00:13:34,170
so that's the benefit of separation oh

338
00:13:38,720 --> 00:13:35,730

is it if there's a whole bunch of means

339
00:13:40,520 --> 00:13:38,730
in there we'll label them but then