

A. Appendix – GCMS spectra of propellants

Figure A.1: Gas Chromatogram of FSSA propellant sample 2



Figure A.2: Mass Spectrum and assignment of FSSA propellant 2 GS peak 3.888 minutes

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| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 9 M | 650 | 737 | 0.16 | Ethanol, 2-chloro-, nitrate |
| $ \begin{bmatrix} 1 & M & 621 & 671 & 0.06 & Bhanol, 2ntro, notate (ester) \\ 12 & M & 608 & 656 & 0.03 & 1.2 + Proparedol, diritate (ester) \\ 13 & M & 602 & 646 & 0.03 & 1.2 + Proparedol, diritate (ester) \\ 14 & M & 602 & 646 & 0.03 & 1.2 + Proparedol, diritate (ester) \\ 15 & M & 581 & 626 & 0.01 & 1.2 + Proparedol, diritate (ester) \\ 15 & M & 581 & 626 & 0.01 & 1.2 + Proparedol, diritate (ester) \\ 17 & M & 559 & 552 & 0.00 & Nitic add, buyl ester \\ 17 & M & 549 & 588 & 0.00 & Nitic add, buyl ester \\ 18 & M & 549 & 588 & 0.00 & Nitic add, buyl ester \\ 19 & M & 511 & 542 & 0.00 & Bhanol, 2.2 conybis, diritate \\ 21 & M & 490 & 524 & 0.00 & Thethylene glycol, monnitate \\ 22 & M & 473 & 515 & 0.00 & 1.3 + Proparedol, 2.2 diritate) \\ 22 & M & 473 & 515 & 0.00 & 1.3 + Proparedol, 2.2 diritate \\ 24 & M & 462 & 481 & 0.00 & Cycletramethylene courann -3 one \\ 24 & M & 462 & 557 & 0.00 & 5 + Mathyl-1, diritate \\ 25 & R & 438 & 462 & 0.00 & 1.3 + Barlydroxynethylene \\ 27 & R & 438 & 462 & 0.00 & 1.3 + Barlydroxynethylene \\ 28 & R & 403 & 901 & 0.00 & Brithene courann -3 one \\ 1.3 + R & 1.3 + Barlydroxynethylene \\ 28 & M & 396 & 418 & 0.00 & Nitic add, perhyl ester \\ 31 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 31 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 31 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 31 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 31 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 31 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 31 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 32 & M & 375 & 395 & 0.00 & Nitic add, perhyl ester \\ 31 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 32 & M & 375 & 395 & 0.00 & Nitic add, perhyl ester \\ 31 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 32 & M & 375 & 395 & 0.00 & Nitic add, perhyl ester \\ 32 & M & 375 & 395 & 0.00 & Nitic add, perhyl ester \\ 33 & M & 334 & 423 & 0.00 & Nitic add, perhyl ester \\ 34 & M & 364 & 435 & 0.00 & Nitic add, perhyl ester \\ 34 & M & 364 & 435 & 0.00 & Nitic add, perhyl ester \\ 34 & M & 364 & 435 & $ | 10 M | 634 | 673 | 0.09 | 1,5-Pentanediol, dinitrate 100- |
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| P. R Nitric acid, pertyl ester | ⊟32 M | 375 | 395 | 0.00 | Ntric acid, pentyl ester 151 165 |
| | R | | | | Ntric acid, pentyl ester |
| (replib) Nitroglycerin | • | | | | * (reolib) Nitrodycerin |
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Figure A.3: Mass Spectrum and assignment of FSSA propellant 2 GS peak 10.172 minutes



Figure A.4: Mass Spectrum and assignment of FSSA propellant 2 GS peak 10.483 minutes

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|---------------------|-------------|----------|-----------------------------|--|
| Names Non | inuctores / | _ | | Spee List Name, Scan 1291 (12.402 min): 2 D\data r 🔺 |
| [| [| | | 100- 100- MW: N/A 10#; 11899 DB; Text Fie |
| # Lib. | Match | R.Match | Prob. (%) | Name 165 Unimers pages |
| | 791 | 919 | 78.1 | Benzene, 1-methyl-2.4-dintro- |
| | | | | Benzene, 1-methyl-2,4-dinitro- |
| ц М | | | | Benzene. 1-methyl-2,4-dinitro- |
| 2 M | /30 | /96 | 13.6 | Benzene, 2-methyl-1,4-dinitro- |
| | 696 | /46 | 3.49 | Benzene, 2/methyl-1,3/dinkro- |
| ⊨ … <u>K</u> | | | | Benzene, Z-methyl-1,3-dinitro- |
| + ⊻ | | 705 | 0.00 | Benzene, Zmethyl-1, 3-dinitro- |
| | 693 | /85 | 3.08 | Benzene, I-methy-2,3-dinkro- |
| l + M | C10 | 007 | 0.40 | Benzene, I-methy-2,3-dintro- |
| 0 M | 618 | 667 | 0.40 | 3-la-ivirophenyipropan-1,2-diamine |
| | 612 | 6/2 | 0.31 | Benzene, 2methoxy-1methyl-3,5dintro- 60 120 180 240 |
| H ⊨ K | | | | Benzene, 2-metroxy-1-metroy-3,3-anitro- |
| l +∵ | 000 | 050 | 0.00 | Plot/Text of Search Spectrum / Plot of Search Spectrum / Plot of Search Spectrum / Plot Text of Spec List / |
| 1 6 M | 608 | 652 | 0.26 | Benzene, 2-mentyi-Antiro-Linitroso- |
| 8 M | 5/9 | /36 | 0.07 | Benzorurazan, Antro- |
| 9 M | 5/6 | /56 | 0.06 | Benzofurazan, S-nitro- |
| 10 M | 5/2 | 616 | 0.05 | Phenol, p-(2-hitrovinyi)- |
| 11 M | 5/1 | 630 | 0.05 | 1-Nitro-4-propylbenzene 50 89 |
| 12 M | 559 | 611 | 0.03 | Benzene, 1-nitro-3-propyl- |
| 13 M | 559 | 584 | 0.03 | Acetamide, 2.2-dichloro-N-(4-httrophenyl)- 51, 78, 106, 1, 136, 149, 182, 203, 217, 235, 252 |
| 14 M | 557 | 606 | 0.03 | 5-Amino-2,4-dimethylbenzoic acid |
| 15 M | 550 | 652 | 0.02 | Isonicotiny/formaldbisoxime 7 II 100 140 182 |
| 16 M | 548 | 607 | 0.02 | Phenol, 2(1benzotriazolyl)-5-nitro- |
| 17 M | 547 | 613 | 0.02 | Acetamide, N-(3-nitrophenyl)-2,2-dichloro- |
| 18 M | 542 | 614 | 0.01 | Benzhydrazide, 3-amino-b-ntro- |
| 19 M | 540 | 584 | 0.01 | 2-Amino-3.5-dimethylbenzoic acid 100- |
| 20 M | 539 | 5/9 | 0.01 | 4-Methoxy-3-nitrobenzyl alcohol, acetate |
| 21 M | 536 | 639 | 0.01 | (3-Nitro-benzy/)phenethyl-amine 40 60 80 100 120 140 160 180 200 220 240 260 |
| 22 M | 534 | 622 | 0.01 | Benzoic acia, (4-metroxy-3-nitrophenyi)metryi ester |
| | 534 | 263 | 0.01 | 4-Nitro-di-phenylalahine Netro A Head to Tail Side by Side & Subtraction / 791 919R 78.1P |
| 1 1 m | | | | 4-Nitro-Ipnertyaianine |
| 1 t | | | | 4-viuroprenyaanine, metrykester) 100- |
| 1 t | | | | 2-hoceysamino-3-4-hitropnemyjpropionic acid, etny ester |
| 1 * • " | | | | Phenykaanine, Ntrillioroacetyi-4-niiro- |
| 1 1 1 1 | 500 | 570 | 0.01 | rnenyalanne, ivamuoraacety-4-nito-, metryi ester |
| 24 M | 500 | 576 | 0.01 | Euranio, 1-44-multipheny/221-pic/Col/2.2.1/hep-22y/eury/animoj- |
| | 052 | 571 | 0.01 | 4-Nincprenyaarine, menykesier) 63 |
| 1 P | | | | 4-runorsprenzysiatrine A Nava i based ta size i a |
| 17. " | | | | entitorus reinitaria 2/4 attendenti berniania paid ethol ester |
| 17. " | | | | 2mocryptiminus - generative and ethyle states |
| | | | | Premylatemine, retinuoradaelyn-4-muo- |
| 1 * 26 M | 529 | 621 | 0.01 | n ner yradamie, nruniautodacigywniauty, neu lyf ester o' |
| 20 M | 020 520 | 562 | 0.01 | Denzialinica, SYulinica uxy myz-sysilopine inf/ |
| 27 M | 526 | 569 | 0.01 | beitzaueriyue, mine iyi-zi iuo' o Tolianeeritoopanide apha 6 (wathithin) 9H.ourin 9u/L |
| 20 11 | 320 | 303 | 0.00 | p - rouge instantion manages apring to the management of the manag |
| Names St | tructures | | | InLib = .228, Hit List / Plot of Hit / |
| | 01 | <u> </u> | N 0 | |
| up. Search | Uther | Search | Indifies Compare | |

Figure A.5: Mass Spectrum and assignment of FSSA propellant 2 GS peak 12.402 minutes



Figure A.6: Mass Spectrum and assignment of FSSA propellant 2 GS peak 12.943 minutes



Figure A.7: Mass Spectrum and assignment of FSSA propellant 2 GS peak 13.426 minutes



Figure A.8: Mass Spectrum and assignment of FSSA propellant 2 GS peak 16.356 minutes



Figure A.9: Mass Spectrum and assignment of FSSA propellant 2 GS peak 16.947 minutes



Figure A.10: Mass Spectrum and assignment of FSSA propellant 2 GS peak 17.092 minutes



Figure A.11: Mass Spectrum and assignment of FSSA propellant 2 GS peak 22.114 minutes



Figure A.12: Gas Chromatogram of FSSA propellant sample 4

| 🚳 🍫 🖻 | 🔤 1. S | can 1303 (| 12.488 min): 4.D\data.ms | | | |
|--------------|------------|------------|--------------------------|--|--|------------|
| | ructures / | | | SpecList | 165 Name: Scan 1303 (12,488 min): 4.D | data.r 🔺 |
| H [18 | Mateh I | 2 Mateh | Deals (%) | Name 1 | MW: N/A ID#: 11907 DB: Text File | |
| # 00. | | 0.025 | P10D. (%) | Processor 1 method 2.4 decise | 10 largest peaks: | |
| | 330 | 330 | 31.0 | Benzene, 1-methyl-2,4-dinitro- | 165 999 89 441 63 190 1 | 19 16 |
| 1 * | | | | Pennene, 1 metal 2.4 diates | /8 100 166 8/ 118 /5 | // /. |
| 1 4 ···· 1 | 014 | 010 | 4.66 | Pennene, 2 method 1.4 dialate | DO SYDODYMS | = |
| | 794 | 833 | 2.12 | Benzene 1.methyle23.dinitro | | |
| M N | 704 | 000 | A. 14 | Benzene 1-methyl-2.3-dinitro- | 89 | |
| 4 B | 782 | 782 | 1.41 | Benzene 2-methyl-1.3-dinitro- | | |
| B B | | | | Benzene, 2-methyl-1,3-dinitro- | | |
| Г. м | | | | Benzene, 2-methyl-1.3-dinitro- | ⁶⁹ 119 | |
| 5 M | 701 | 713 | 0.15 | 3-(4-Nitrophenyl)propan-1,2-diamine | 182 225 | |
| 6 M | 653 | 728 | 0.03 | Benzofurazan, 5-nitro- | | |
| ⊟7 R | 651 | 660 | 0.02 | Benzene, 2-methoxy-1-methyl-3,5-dinitro- | 60 120 180 240 | |
| Б R | | | | Benzene, 2-methoxy-1-methyl-3,5-dinitro- | t File) Scan 1303 (12.488 min): 4.D\data.ms | ' |
| L M | | | | Benzene, 2-methoxy-1-methyl-3,5-dinitro- | Viext of Search Spectrum Plot of Search Spectrum Plot fext of Spec List | |
| 8 M | 647 | 656 | 0.02 | Phenol, p-(2-nitrovinyl)- | 165 | |
| 9 M | 621 | 690 | 0.00 | Benzofurazan, 4-nitro- 1 | H 17 | |
| 10 M | 619 | 626 | 0.00 | Benzoic acid, (4-methoxy-3-nitrophenyl)methyl ester | | |
| 11 M | 616 | 644 | 0.00 | (3-Nitro-benzyl)-phenethyl-amine | 89 | |
| 12 M | 615 | 623 | 0.00 | Benzene, 2-methyl-4-nitro-1-nitroso- | | |
| 13 M | 612 | 645 | 0.00 | Benzhydrazide, 3-amino-5-nitro- | 51 78 119 | 250 |
| 14 M | 600 | 612 | 0.00 | 5-Amino-2,4-dimethylbenzoic acid | 230 10 10 10 230 | 200 |
| 15 M | 597 | 621 | 0.00 | Phenol, 2-(1-benzotriazolyl)-5-nitro- | 40 51 78 106 1 130 148 182 | |
| 16 M | 597 | 604 | 0.00 | 4-Methoxy-3-nitrobenzyl alcohol, acetate | 63 | |
| □ 17 M | 590 | 649 | 0.00 | Benzoic acid, 2-hydroxy-3-nitro- | 7 89 | |
| | | | | Benzoic acid, 2-hydroxy-3-nitro- | | |
| Ц н К | | | | Benzoic acid, 2-hydroxy-3-nitro- | - | |
| 4 m | 500 | c | 0.00 | Benzoic acid, 2-hydroxy-3-ntro-, methyl ester | | |
| 10 M | 000 | 627 | 0.00 | Benzamide, 3,4-dimetnoxy-IV-(2-cyanophenyi)- | 40 60 80 100 120 140 160 180 200 220 240 | 260 |
| 20 M | 501 | 500 | 0.00 | 1.Nitro 4 provideo sepa | can 1303 (12.488 min): 4.D'IHead to Tail MF=935 KMF=9351▼Benzene, 1-methyl-2 | 4-dinitro- |
| 20 M | 581 | 594 | 0.00 | 2.4mino-3.5-dimethylhenzoic acid | Telefice / Head to Tall / Side by Side / Subtraction / 935 935 | K 91.0P |
| 22 M | 581 | 599 | 0.00 | Benzoic acid 2/av/dmar/Jubit dold | 165 | |
| 23 M | 574 | 589 | 0.00 | Benzene 1-nitro-3-nmpvl- | | |
| 24 M | 572 | 634 | 0.00 | Isonicotinyl-formaldbisoxime | | |
| 25 M | 572 | 584 | 0.00 | Formic acid, (4-methoxy-3-nitrophenyl)methyl ester | | |
| 26 M | 570 | 666 | 0.00 | 1H-Benzotriazole, 1-(benzylideneamino)- | 1 | |
| 27 M | 570 | 578 | 0.00 | Ethanol, 1 (4-nitrophenyl)-2-[1-(bicyclo[2.2.1]hept-2-yl)ethylamino] | | |
| ⊟28 M | 565 | 667 | 0.00 | 1,3-Benzodioxole-5-carboxylic acid | | |
| . R | | | | 1,3-Benzodioxole-5-carboxylic acid | 1 I IVI . | 0 |
| L R | | | | 1,3-Benzodioxole-5-carboxylic acid | | ~ |
| ↓ R | | | | 1,3-Benzodioxole-5-carboxylic acid | | |
| m | | | | 1,3-Benzodioxole-5-carboxylic acid, methyl ester | 119 Ö | |
| 1 | | | | 1,3-Benzodioxole-5-carboxylic acid, methyl ester | 106 182 | |
| L_* m | | | | 1,3-Benzodioxole-5-carboxylic acid, tert-butyldimethylsilyl ester | 40 136 148 | |
| 29 M | 563 | 570 | 0.00 | Benzaldehyde, 4-methyl-2-nitro- | 40 60 80 100 120 140 160 180 200 220 24 | J 260 |
| Names A Str | ructures / | | | InLib = 288 Hitlist | hlb) Benzene, 1-methyl-2,4-dinitro- | |
| - | | | | | | |
| Lib. Search | Other S | earch | Names Compare | Librarian MSMS | | |

Figure A.13: Mass Spectrum and assignment of FSSA propellant 4 GS peak 12.488 minutes



Figure A.14: Gas Chromatogram of FSSA propellant sample 6

| 🐿 🏷 | 🔎 🖷 | 🔤 1. Scan 97 | 9 (10.151 min): 6.D\data.ms 💌 | J 🔞 🕒 🔍 🔍 | | | | | | |
|-----------------|---------|--------------------|-------------------------------|--|---------------|----------|------------------------|------------------------------|-------------------------------|----------------------------|
| Names | | nes / | | | Spec List | | 46 | | Name: Scan 979 (| 10.151 min): 6.D\data.m: 🔺 |
| # | lib IN | latch B Match | Prob. (%) | Name | | 100- | Ĩ | | MW: N/A ID#: 11 Comment: 6 | 908 DB: Text File |
| - | 8. j 14 | 664 810 | 53.0 | Name Nitic acid athyl astar | | | | | 10 largest peaks: | |
| | R | | | Nitric acid, ethyl ester | | | | | 46 999 /61 | 195 44 1/8 42 2 |
| 1.5 | м | | | Nitric acid, ethyl ester | | 1 | | | Synonyms: | 13 230 14 233 1 |
| 2 | M | 627 787 | 12.9 | 1.2.3-Propanetriol. 1-nitrate | | | | | no synonyms. | |
| 3 | M | 619 820 | 9.62 | Ethylene glycol, dinitrate | | 50- | | ? | | |
| 4 | м | 616 761 | 8.50 | 1.4-Butanediol, dinitrate | E | | | | | |
| 5 | R | 614 755 | 7.84 | Ntroalvcerin | | | | | | |
| L | R | | | Ntroglycerin | | | 76 | | | |
| L | м | | | Ntroglycerin | | | -TT | | | |
| 6 | R | 598 733 | 4.51 | Ntric acid, propyl ester | | | | 10 252 40 | | |
| . | R | | | Nitric acid, propyl ester | | 0 | | 49 | <u>+</u> | - |
| l i I | М | | | Nitric acid, propyl ester | | | 1. | 20 240 360 480 | | |
| 7 | М | 556 716 | 1.01 | 1,3-Propanediol, dinitrate | | (lext | ile) Sca | n 9/9 (10.151 min): 6.D\data | .ms • · · · · | r d Court list |
| 8 | М | 554 680 | 0.93 | 1,5-Pentanediol, dinitrate | | | extors | earch spectrum A Plot of a | earch spectrum / Plot i | ext or spec tist |
| 9 | М | 545 687 | 0.67 | 1,2-Propanediol, 3,3'-oxydi-, tetranitrate | | | 46 | | | |
| ⊡ 10 | R | 530 748 | 0.41 | Methyl nitrate | | 100- | ĩ | | | |
| [| М | | | Methyl nitrate | | | | | | |
| 11 | M | 503 646 | 0.12 | 1,2-Propanediol, dinitrate | | 50 | | | | |
| ⊡12 | R | 501 587 | 0.11 | Nitric acid, butyl ester | | 50- | | | | |
| l | М | | | Nitric acid, butyl ester | | | - L. | /6 | 252 | |
| 13 | M · | 495 681 | 0.08 | Ethanol, 2-chloro-, nitrate | | 0- | - P4 | 84 119 151 185 | 202 | 484 |
| 14 | M · | 490 615 | 0.07 | 1,2,3-Propanetriol, 1,3-dinitrate | | | 15/ | 31 | | |
| 15 | M · | 486 619 | 0.05 | 1,3-Propanediol, 2-methyl-2-nitro-, dinitrate | | | | 76 | | |
| 16 | M · | 473 624 | 0.03 | 1,3-Propanediol, 2-methyl-2-[(nitrooxy)methyl]-, dinitrate (ester) | | 50- | | | | |
| 17 | M · | 463 567 | 0.02 | Pentaerythritol Tetranitrate | | | | | | |
| 18 | M · | 458 580 | 0.02 | Ntroisobutanetriol trinitrate | | 100- | | | | |
| 19 | M · | 448 540 | 0.01 | 1,2,4-Trioxolane | | | 46 | | | |
| 20 | M · | 433 557 | 0.00 | 5-Methyl-4'-hydroxy-2-benzylidene-coumaran-3-one | | | 50 | 100 150 200 | 250 300 350 | 400 450 500 |
| ⊟21 | M | 414 586 | 0.00 | Acetone-D6 | | A Sca | n 979 (1 | 10.151 min): 6.D\cHead to Ta | al MF=664 RMF=810 🔻 | Nitric acid, ethyl ester |
| l | R | | | Acetone-D6 | | Diffe | rence A | Head to Tail Side by Side | Subtraction | 664 810R 53.0P |
| 22 | M | 408 517 | 0.00 | Triethylene glycol, mononitrate | | <u> </u> | | | | |
| E ²³ | R · | 401 487 | 0.00 | 1,3-Bis(hydroxymethyl)urea | | 100- | 46 | | | |
| • | M | | | I, 3-Bis(hydroxymethyl)urea | | | | | | |
| 24 | M | 401 463 | 0.00 | Cyclotetramethylenetetranitramine | | | | | | |
| E ²⁵ | R : | 393 559 | 0.00 | Hydrazine, methyl- | | | | | | |
| - | ĸ | | | Hydrazine, methyl- | | | | | 0 | |
| } ∼ | к | | | Hydrazine, metnyl- | | | | | Ĭ | |
| 1 h | IVI | | | nyurazine, metriyi- | | 50- | | | | |
| 1.200 | n D | 201 440 | 0.00 | nyarazine, n-propionyi-in-methyi- | | | | | | |
| P ²⁶ | | 301 449 | 0.00 | 1 Detected 2 method attests | | | | | × 0 0 | |
| 27 | M · | 270 420 | 0.00 | 2 (2 Hydraw, Creathylanaw) 4(2H) avianaliana | | | | 76 | | |
| 2/ | M | 370 435 | 0.00 | 3-(2-rhydroxy-onfiethylphenyl)-4(3-rt)-quinazolinone | | | | | | |
| 20 | M | 300 403 305 473 | 0.00 | 1.2 Press and al. 2.2 dimethod distants | | | 67 | 01 | | |
| -20 | M | 363 4/3 | 0.00 | Carbon diaulida | - | | 10/ | 21 | | |
| 1 | | 420 | 0.00 | | | | 50 | 100 150 200 | 250 300 350 | 400 450 500 |
| Names | Structu | ires / | | InLib = -i | 746, Hit List | Plot/ | Nitric ac ext of Hi | it A Plot of Hit | | |
| 14.0 | Г | Other Seams | Namaa Carraa | Librarian MCMC | | , | | | | |
| LID. Se | arcn | other search | Compare | | | | | | | |

Figure A.15: Mass Spectrum and assignment of FSSA propellant 6 GS peak 10.151 minutes



Figure A.16: Mass Spectrum and assignment of FSSA propellant 6 GS peak 12.395 minutes

| 🚳 🗫 🖻 | — 1. | Scan 1431 | (13.412 min): 6.D\data.ms | - 🚱 🖶 💽 🔍 | | | | | | | | | |
|---------------------------------------|-------------|-----------|---------------------------|---|-------------------------|------------|--------------|-----------------|----------------|---------------|--|--------------|------------|
| Names Non | | | | | Spec List | | | 69 | | Name: Sc | an 1431 (13. | 412 min): 6. | D\data.r 🔺 |
| # Lib | Match | R Match | Prob. (%) | Name | • | 100- | | Ĩ | | Comment: | 00000000000000000000000000000000000000 | DB: Text H | le 🗍 |
| | 673 | 848 | 20.7 | Diphenylamine | | | | | | 10 largest | peaks: | | |
| | | 0.0 | 20.7 | Diphenylamine | | | | | | 169 999 | 168 700 | 167 638 | 44 59 |
| L. R | | | | Diphenylamine | | | | | | Synonyms | 233 1301 | 104 144 | 170 IS |
| Б., R | | | | Diphenylamine | | | 44 | Ý | | no synony | ms. | | |
| L m | | | | Acetamide, N.N-diphenyl- | | 50- | | | | | | | |
| 1 | | | | Acetamide, N,N-diphenyl- | | | | | | | | | |
| li, m | | | | Trifluoroacetamide, N,N-diphenyl- | = | | | 252 | | | | | |
| ⊟2 R | 672 | 860 | 19.9 | [1,1'-Biphenyl]-2-amine | - | | | 252 | | | | | |
| ₊ R | | | | [1,1'-Biphenyl]-2-amine | | | 77 | ահ հ | | | | | |
| . R | | | | [1,1'-Biphenyl]-2-amine | | | ենն | | 484 | | | | |
| | | | | [1,1'-Biphenyl]-2-amine | | 0- | 120 | 240 3 | 60 480 | · | | | - |
| m m | | | | Acetamide, N-(1,1'-biphenyl)-2-yl- | | Text | File) Scan 1 | 431 (13 412 mi | n):6 D\data m | • | | | • |
| | | | | Acetamide, N-(1,1'-biphenyl)-2-yl- | | Plot | Text of Sea | ch Spectrum | Plot of Searc | h Spectrum | Plot/Text of | f Spec List | / |
| 1 1 | | | | 2-Aminobiphenyl, N-(tert-butyldimethylsilyl)- | | - | | | | | | | |
| 1 - m | | | | 2-Aminobiphenyl, N-trimethylsilyl- | | 100 | | 16 | 59 | | | | |
| 1 4° m | C40 | 770 | 0.00 | 2-Aminobiphenyl, N,N-di(trifiuoroacetyl)- | | 100- | | | | | | | |
| 3 M | 646 | //3 | 0.00 | 2 Method 2 sharedeniding | | 1 1 | 44 | | | | | | |
| | 646 | 003 | 0.14 | 2-metriyi-s-prienyipyilaine | | 50- | | | | | | | |
| | 040 | 010 | 0.14 | Hydrazinecarboxamide, N.N.diphenyl- | | | 77 | 154 | 183 2 | 52 | | | |
| 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 634 | 783 | 4.09 | [1 1'-Bioberyll-3-amine | | | الأنديات | 103 129 '** | d. ad | | | | 484 |
| R R | | | | [1 1'-Biphenyl]-3-amine | | ľ | | 115 141 | | | | | |
| -7 M | 633 | 781 | 3.93 | Pvridine, 3-methyl-2-obenyl- | | 1 1 | 51 77 | | | | | | |
| IL. R | | | | Pvridine, 3-methyl-2-phenyl- | | 50- | | | | | | | |
| — ™ 8 M | 630 | 792 | 3.47 | Pyridine, 4-(phenylmethyl)- | | | | | | | | | |
| ⊑ R | | | | Pyridine, 4-(phenylmethyl)- | | 100 | | | | | | | |
| L R | | | | Pyridine, 4-(phenylmethyl)- | | | | 16 | 59 | | | | |
| 9 R | 628 | 798 | 3.20 | Pyridine, 3-(phenylmethyl)- | | L | 50 | 100 150 | 200 2 | 50 300 | 350 | 400 45 | 0 500 |
| L _∎ M | | | | Pyridine, 3-(phenylmethyl)- | | ▲Sc | an 1431 (13 | 412 min): 6.D'l | Head to Tail M | F=673 RMF=8 | 48 🔻 | Diphenylar | nine |
| 10 M | 625 | 787 | 2.83 | 3-Methyl-5-phenylpyridine | | Diff | erence A He | ad to Tail 🖊 S | ide by Side 入 | Subtraction / | | 673 8 | 48R 20.7P |
| □ ¹¹ M | 620 | 773 | 2.28 | N-Nitrosodiphenylamine | | | | | | | | | |
| + B | | | | N-Nitrosodiphenylamine | | 100- | | 16 | 9 | | | | |
| <u>ь</u> н | | | | N-Nitrosodiphenylamine | | | | | | | | | |
| | 620 | /60 | 2.28 | [1,1-Biphenyi]-4-amine | | | | | | | | | |
| 1 h · · · · · · | | | | [1,1-Biphenyl]-4-amine | | | | | | | | | |
| | | | | [1,1-biphenyl]-4-amine | | | | | ~ | _ | / | | |
| 1 * | | | | [1,1-biphenyl]-4-amine | | | | | - 17 | \sim | / | \frown | |
| | | | | N N-Diacetyl-A-binbenylamine | | 50- | | | | | NH | () | |
| 1 | | | | 4-Acetylaminnbinhenyl | | | | | | <u> </u> | | <u> </u> | |
| li i i | | | | 4-Acetylaminobiphenyl | | | | | | | | | |
| LL m | | | | 4-Aminobiphenyl, N.N-di(trifluoroacetyl)- | | 1 | 51 84 | | | | | | |
| E13 R | 616 | 721 | 1.92 | Pheniramine | | | - I . Ŭ | 115 141 | | | | | |
| 🛛 🖡 R | | | | Pheniramine | | | | 10 141 | | | | | |
| L R | | | | Pheniramine | * | 1 04 | 50 | 100 150 | 200 2 | 50 300 | 350 | 400 45 | 0 500 |
| ٠ | | | | | 4 | (main | b) Diphenyli | amine | | | | | |
| Names St | tructures | | | | InLib = -1048, Hit List | Plot | Text of Hit | Plot of Hit | | | | | |
| Lib. Search | Other | Search | Names Compare | Librarian MSMS | | | | | | | | | |

Figure A.17: Mass Spectrum and assignment of FSSA propellant 6 GS peak 13.412 minutes



Figure A.18: Mass Spectrum and assignment of FSSA propellant 6 GS peak 17.005 minutes



Figure B.1: HPLC Chromatogram of propellant standard mixture



Figure B.2: HPLC Chromatogram of FSSA sample 1

B. Appendix – HPLC spectra of propellants



Figure B.3: HPLC Chromatogram of FSSA sample 2



Figure B.4: HPLC Chromatogram of FSSA sample 3



Figure B.5: HPLC Chromatogram of FSSA sample 4



Figure B.6: HPLC Chromatogram of FSSA sample 5



Figure B.7: HPLC Chromatogram of FSSA sample 6



Figure B.8: HPLC Chromatogram of FSSA sample 7



Figure B.9: HPLC Chromatogram of FSSA sample 8



Figure B.10: HPLC Chromatogram of FSSA sample 9



Figure B.11: HPLC Chromatogram of FSSA sample 10



Figure B.12: HPLC Chromatogram of FSSA sample 11



Figure B.13: HPLC Chromatogram of FSSA sample 12



Figure B.14: HPLC Chromatogram of FSSA sample 13



Figure B.15: HPLC Chromatogram of FSSA sample 14



Figure B.16: HPLC Chromatogram of FSSA sample 15



Figure B.17: HPLC Chromatogram of FSSA sample 16



Figure B.18: HPLC Chromatogram of FSSA sample 17



Figure B.19: HPLC Chromatogram of FSSA sample 18



Figure B.20: HPLC Chromatogram of FSSA sample 19

C. Appendix Mid-Far IR spectra of propellants



Figure C.1: IR spectrum of FSSA sample 1



Figure C.2: IR spectrum of FSSA sample 2



Figure C.3: IR spectrum of FSSA sample 3



Figure C.4: IR spectrum of FSSA sample 4



Figure C.5: IR spectrum of FSSA sample 6



Figure C.6: IR spectrum of FSSA sample 7



Figure C.7: IR spectrum of FSSA sample 8



Figure C.8: IR spectrum of FSSA sample 9



Figure C.9: IR spectrum of FSSA sample 10



Figure C.10: IR spectrum of FSSA sample 11



Figure C.11: IR spectrum of FSSA sample 12



Figure C.12: IR spectrum of FSSA sample 13



Figure C.13: IR spectrum of FSSA sample 14



Figure C.14: IR spectrum of FSSA sample 15



Figure C.15: IR spectrum of FSSA sample 16



Figure C.16: IR spectrum of FSSA sample 17



Figure C.17: IR spectrum of FSSA sample 18



Figure C.18: IR spectrum of FSSA sample 19



Figure C.19: IR spectrum of Victoria Police sample 91



Figure C.20: IR spectrum of Victoria Police sample 100



Figure C.21: IR spectrum of Victoria Police sample 103



Figure C.22: IR spectrum of Victoria Police sample 119



Figure C.23: IR spectrum of Victoria Police sample 126



Figure C.24: IR spectrum of Victoria Police sample 146



Figure C.25: IR spectrum of Victoria Police sample 253



Figure C.26: IR spectrum of Victoria Police sample 256



Figure C.27: IR spectrum of Victoria Police sample 274



Figure C.28: IR spectrum of Victoria Police sample 279



Figure C.29: IR spectrum of Victoria Police sample 285



Figure C.30: IR spectrum of Victoria Police sample 303



Figure C.31: IR spectrum of Victoria Police sample 304



Figure C.32: IR spectrum of Victoria Police sample 305

D. Appendix – LDI spectra of propellants



Figure D.1: LDI spectrum of propellant solvation solids FSSA sample 1


Figure D.2: LDI spectrum of propellant solvation solids FSSA sample 2



Figure D.3: LDI spectrum of propellant solvation solids FSSA sample 3



Figure D.4: LDI spectrum of propellant solvation solids FSSA sample 4



Figure D.5: LDI spectrum of propellant solvation solids FSSA sample 6



Figure D.6: LDI spectrum of propellant solvation solids FSSA sample 7



Figure D.7: LDI spectrum of propellant solvation solids FSSA sample 8



Figure D.8: LDI spectrum of propellant solvation solids FSSA sample 9



Figure D.9: LDI spectrum of propellant solvation solids FSSA sample 10



Figure D.10: LDI spectrum of propellant solvation solids FSSA sample 11



Figure D.11: LDI spectrum of propellant solvation solids FSSA sample 12



Figure D.12: LDI spectrum of propellant solvation solids FSSA sample 13



Figure D.13: LDI spectrum of propellant solvation solids FSSA sample 14



Figure D.14: LDI spectrum of propellant solvation solids FSSA sample 15



Figure D.15: LDI spectrum of propellant solvation solids FSSA sample 16



Figure D.16: LDI spectrum of propellant solvation solids FSSA sample 17



Figure D.17: LDI spectrum of propellant solvation solids FSSA sample 18



Figure D.18: LDI spectrum of FSSA sample 1



Figure D.19: LDI spectrum of FSSA sample 2



Figure D.20: LDI spectrum of FSSA sample 3



Figure D.21: LDI spectrum of FSSA sample 4



Figure D.22: LDI spectrum of FSSA sample 6



Figure D.23: LDI spectrum of FSSA sample 7



Figure D.24: LDI spectrum of FSSA sample 8



Figure D.25: LDI spectrum of FSSA sample 9



Figure D.26: LDI spectrum of FSSA sample 10



Figure D.27: LDI spectrum of FSSA sample 11



Figure D.28: LDI spectrum of FSSA sample 12



Figure D.29: LDI spectrum of FSSA sample 13



Figure D.30: LDI spectrum of FSSA sample 14



Figure D.31: LDI spectrum of FSSA sample 15



Figure D.32: LDI spectrum of FSSA sample 16



Figure D.33: LDI spectrum of FSSA sample 17



Figure D.34: LDI spectrum of FSSA sample 18



Figure D.35: LDI spectrum of FSSA sample 19



Figure D.36: LDI spectrum of stabilizer mixture



Figure D.37: LDI spectrum of 2,4-DNT



Figure D.38: LDI spectrum of 2,6-DNT



Figure D.39: LDI spectrum of 2nDPA



Figure D.40: LDI spectrum of 4nDPA



Figure D.41: LDI spectrum of AKII



Figure D.42: LDI spectrum of DBP



Figure D.43: LDI spectrum of DPA



Figure D.44: LDI spectrum of EC



Figure D.45: LDI spectrum of MC



Figure D.46: LDI spectrum of nitrocellulose



Figure D.47: LDI spectrum of nitroglycerin



Figure D.48: LDI spectrum of NnitrosoDPA



Figure D.49: Negative LDI spectrum of nitrocellulose



Figure D.50: Negative LDI spectrum of 2nDPA



Figure D.51: Negative LDI spectrum of 4nDPA



Figure D.52: Negative LDI spectrum of EC



Figure D.53: Negative LDI spectrum of NnitrosoDPA



Figure D.54: LDI spectrum of 4nDPA in ethanol



Figure D.55: LDI spectrum of DBP in ethanol



Figure D.56: LDI spectrum of DPA in ethanol


Figure D.57: LDI spectrum of MC in ethanol



Figure D.58: LDI spectrum of NnitrosoDPA in ethanol





Figure D.60: Negative LDI spectrum of 4nDPA in ethanol



Figure D.61: Negative LDI spectrum of DBP in ethanol



Figure D.62: Negative LDI spectrum of DPA in ethanol



Figure D.63: Negative LDI spectrum of EC in ethanol



Figure D.64: Negative LDI spectrum of nitrocellulose in ethanol



Figure D.65: Negative LDI spectrum of nitroglycerin in ethanol



Figure D.66: Negative LDI spectrum of NnitrosoDPA in ethanol



Figure D.67: LDI spectrum of DST group sample A



Figure D.68: LDI spectrum of DST group sample B



Figure D.69: Spectrum of DST group sample C



Figure D.70: LDI spectrum of DST group sample D



Figure D.71: LDI spectrum of DST group sample A in ethanol



Figure D.72: LDI spectrum of DST group sample B in ethanol



Figure D.73: LDI spectrum of DST group sample C in ethanol



Figure D.74: LDI spectrum of DST group sample D in ethanol